OIC WATER REPORT

Transforming Risk into Dialogue and Cooperation

2018

SESRIC

ORGANISATION OF ISLAMIC COOPERATION

STATISTICAL, ECONOMIC AND SOCIAL RESEARCH AND TRAINING CENTRE FOR ISLAMIC COUNTRIES

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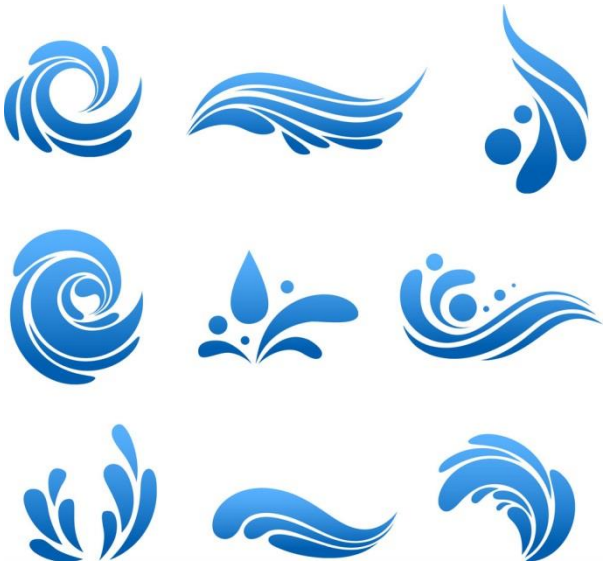

Organization of Islamic Cooperation

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CONTENTS

ACRONYMS

BAU	Business as Usual
ERWR	External Renewable Water Resources
FAO	Food and Agriculture Organization of the United Nations
IRWR	Internal Renewable Water Resources
IWMI	International Water Management Institute
MDGs	Millennium Development Goals
MENA	Middle East and North Africa
OIC	Organisation of Islamic Cooperation
SESRIC	The Statistical, Economic and Social Research and Training Centre for Islamic Countries
SDGs	Sustainable Development Goals
TFWW	Total Freshwater Withdrawal
TRWR	Total Renewable Water Resources
UN	United Nations
UNGA	United Nations General Assembly
UNICEF	The United Nations Children's Fund
Water-CaB	SESRIC's Water Resources Management Capacity Building Programme
WHO	World Health Organisation

FOREWORD

The OIC presents a group of countries that are highly diverse in terms of geography, demography, and economic development level. Nonetheless, many of them face common water constraints and challenges. Population growth in the OIC as a group is relatively high. A growing population requires water not only to drink, but also to meet its increased food, industry, municipal and energy production needs. Rapid urbanization, increased economic activity and rising consumptuion place further pressures on water demand, while non-revenue water, pollution, climate change, hydrologic variability, land use and changing ecosystems limit water availability. Increased demand and limited availability of water will inevitably affect the sustainability of agriculture - the biggest water consumer - and industry. This, in turn, will affect OIC countries' ability to produce the products and services necessary for sustaining and improving current standards of living.

If OIC countries do not act soon, it will be more likely to observe increased water shortages, health crises, and disputes and conflicts over water throughout the OIC region. This could be particularly a concern for the water stressed OIC countries, where businesses, farms and residents are already vulnerable to the slightest change in fresh water supply, growing population and competing sectoral demands for water. Conflicts over fresh water are increasing globally, but they are increasing even more sharply in the in the OIC region. During the period May 1960 to 2018, 56% of world water conflicts were recorded in OIC countries. After 2010, fresh water in the OIC region was behind more violence than ever contributing to 67% of global water conflicts.

OIC countries face great water challenges, but these challenges are not insurmountable. As the OIC Water Vision points point, OIC nations are guided by the noble Islamic values of unity, fraternity and solidarity. These values provide an extraordinary opportunity for its member states to work together to ensure a water secure future, sharing varied experiences and learning from what has and has not worked.

In this regard, the OIC Water Report 2018 presents objective information and analyses on the current state and challenges facing OIC member countries in this important area. We pray Allah, the Almighty, that this report of SESRIC will be useful in expanding the body of knowledge in the OIC member countries in this field. We hope the report will contribute to the decision making process in OIC member countries in the domain of water through enacting appropriate policies and strategies that will enable the OIC countries to successfully address the water challenges they face.

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Director General
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EXECUTIVE SUMMARY

PART I: CURRENT STATE AND MAJOR TRENDS

Water Availability

One of the major challenges facing OIC countries is limited water availability. The OIC share of the world's total renewable water resources is 13.3%, less than their share in the world's total population of 23.6%. This is in direct contrast to non-OIC developing countries and developed countries that enjoy a share of the world's total renewable water resources higher than their shares of the world's population. However, the OIC member countries are dispersed over a huge land area in four continents with different climates where some of them enjoy high precipitation; while other suffer from very arid climate with closed hydrologic systems. Therefore, water availability in different OIC regions exhibits high variability. For example, the OIC countries in East Asia have the highest amount of total renewable water resources (2,608 billion m^3), while OIC countries in the Middle East and North Africa have the lowest (361 billion m^3). At the individual country level; the highest amount of total renewable water resources is found in Indonesia (2.019 billion m^3/year) followed by Bangladesh (1.227 billion m^3/year) and Malaysia (580 billion m^3/year). On the other hand, the lowest amount of total renewable water resources is observed in Kuwait (0.02 billion m^3/year) followed by Maldives (0.03 billion m^3/year) and Qatar (0.06 billion m^3/year).

OIC countries in the Middle East and North Africa are home to many of the world's major aquifers containing non-renewable water resources. Since these countries suffer from arid climates where renewable water resources are limited, their non-renewable water resources or fossil water is considered an important strategic resource offering an opportunity to alleviate the limitation of renewable water resources, improve social welfare and facilitate economic development. It is not, therefore, surprising that the highest global utilisation rates of non-renewable water resources are recorded in these countries. For example, it is estimated that 77% of the total world extraction of non-renewable groundwater takes place in only two countries in this region, namely Saudi Arabia and Libya.

On the other hand, the inadequate water infrastructures in many OIC countries make the challenge of the limited water availability more serious. For example, dam capacity in OIC countries stands at 661 m^3/inhabitant, a rate that is lower than the 790 m^3/inhabitant observed in non-OIC developing countries; and significantly lower than the 1874 m^3/inhabitant

observed in developed countries. Another example is water treatment facilities; the proportion of collected wastewater that is treated in OIC countries is only 43.7%. This proportion is lower than the 50.9% observed in non-OIC developing countries and seriously lags behind that in developed countries where 95.5% of collected wastewater is treated.

An important dimension of water availability is the proportion of available water that originates from outside the boarders of the country aka, "water dependency." In OIC countries, 73% of total renewable water resources generate internally while 27% generate externally, thus resulting in a dependency ratio of 27.4. The dependency ratio in OIC countries is higher than the 24.1 observed in non-OIC developing countries and the 6.8 ratio observed in developed countries.

Water Demand

The global demand for water is steadily increasing and is being driven by a number of anthropogenic factors of which population growth stands out as the main factor. Nowhere in the world does this factor exhibit its influence on increasing water demand than in OIC countries. The rate of population growth in OIC countries outpaces that in other country groups. Whereas the OIC share of the world population was 20.9% in the year 2000, it is projected to reach 25.3% in the year 2025 and 29.8% in the year 2050. The increased demand for water in the OIC countries is also being driven by increasing urbanisation, increasing incomes and growing economies and new patterns in consumerism.

The demand for water in OIC countries far exceeds that in non-OIC developing countries. Whereas the annual total water withdrawal per capita in OIC countries is $622m^3$/inhabitant/year; the figure in non-OIC developing countries stands at $391m^3$/inhabitant/year. The demand for water shows large variances across regions and this is a reflection of many factors such as income level, economic development level, availability of water resources and consumption behaviours. OIC countries in Latin America record the highest level of annual total water withdrawal per capita ($1580m^3$/inhabitant/year). Next in line are OIC countries in Europe and Central Asia with an annual total water withdrawal per capita of $1253m^3$ and OIC countries in the Middle East and North Africa with $899m^3$. The lowest annual total water withdrawal per capita is observed in OIC countries in Sub-Saharan Africa with a mere $158m^3$, followed by OIC countries in East Asia with $515m^3$ and OIC countries in South Asia with $672m^3$.

The increasing demand for water in the OIC countries is placing unprecedented pressure on existing water resources. The pressure on water resources in OIC countries is 12.2% and far exceeds the 5.3% observed in non-OIC developing countries and the 9.1% observed in developed countries. The pressure on water resources is highest in OIC countries in the arid and dry region of the Middle East and North Africa, where pressure on water resources recorded an alarming value of 79.6%. Next in line are: OIC countries in Europe and Central Asia with pressure on water resources recorded at 33.6% and OIC countries in South Asia at 15.6%. On the other hand, OIC countries in Latin America, Sub-Saharan Africa and East Asia

face low pressure on water resources estimated at 0.6%, 3.2% and 4.8% respectively. At the individual country level, pressure on water resources is the direst in nine countries, namely Kuwait, UAE, Saudi Arabia, Libya, Qatar, Bahrain, Yemen, Turkmenistan and Uzbekistan, where fresh water withdrawals exceed total renewable water resources.

The increasing demand for water and the resulting high pressure on existing water resources in the OIC countries indicate the importance of using water resources in the most possible productive manner. However, in OIC countries, each one cubic meter of total freshwater withdrawal corresponds to 6.8 US$ of GDP. This compares poorly with water productivity in non-OIC developing countries where GDP per cubic meter of total freshwater withdrawal equals 9.7 US$, and is astronomically behind developed countries where GDP per cubic meter of total freshwater withdrawal equals 50.1 US$.

Water scarcity is a fact of life in the arid and dry region of the Middle East and North Africa. OIC countries in this region have average annual total renewable water resources that stand at 858m^3 per capita, which is below the threshold of 1,000m^3, and this puts them among the countries facing chronic water shortages. Although OIC countries in Europe and Central Asia, Sub-Saharan Africa and South Asia, and do not, according to the definition, suffer from water shortage, they do suffer from low levels of total renewable water resources per capita which recorded at 3,160m^3, 3,916m^3, and 4,001m^3, respectively.

At the individual country level, the issue of water scarcity in OIC countries is bleak with almost half of them face different levels of water scarcity. More specifically, absolute water scarcity is observed in 14 OIC countries, namely Kuwait, United Arab Emirates, Qatar, Saudi Arabia, Yemen, Maldives, Bahrain, Libya, Jordan, Palestine, Algeria, Djibouti, Oman and Tunisia. Chronic water shortages are observed in six OIC countries, namely Egypt, Syria, Burkina Faso, Morocco, Lebanon and Sudan. Finally, water is also scarce in another six OIC countries that experience regular water stress, namely Pakistan, Somalia, Uganda, Comoros, Nigeria, and Uzbekistan.

Balancing Water Use and Food Production

As OIC countries undergo rapid urbanisation and economic development, more demand for water will come from municipal and industrial use. Meeting the demand for water from municipal and industrial use is vital for OIC countries to achieve their development goals; however, this carries the threat of diverting water resources from agricultural with all the negative and dangerous implications it has for food security.

Agricultural water use in OIC countries, which accounts for 84% of all water withdrawal, exceeds that observed in non-OIC developing countries (76%) and developed countries (39%). In OIC countries, municipal water use, which accounts for 9% of all water withdrawal, exceeds that of industrial water use, which accounts for 7% of all water withdrawal. This is in direct contrast with what is observed in non-OIC developing countries, developed countries and the world, where industrial water use surpasses that of municipal water use.

At the OIC regional level, the highest agricultural use of water is observed in OIC countries in South Asia, where it accounts for 93% of all water withdrawals. OIC countries in Latin America and OIC Countries in the Middle East and North Africa follow with agricultural water withdrawals accounting for 87% and 86% of all water withdrawals respectively. On the other hand, the lowest agricultural water use is observed in OIC countries in East Asia, followed by OIC countries in Sub-Saharan Africa and OIC countries in Europe and Central Asia, where it accounts for 67%, 82%, and 83% of all water withdrawal respectively.

The highest level of industrial water use as a percentage of totals is observed in OIC countries in East Asia (21%) followed by OIC countries in Europe and Central Asia (9%), and OIC countries in Latin America (8%). When it comes to municipal water use, the highest level of use as a percentage of total is observed in OIC countries in Sub-Saharan Africa (13%), followed by OIC countries in East Asia (12%) and OIC Countries in Europe and Central Asia and OIC countries in the Middle East and North Africa (both 8%)

Water resources form the base of food production, and in this respect, irrigation can increase the yields of most crops significantly, thus irrigation holds the most potential for increasing food production and increasing food security. In spite of this fact, the area equipped for irrigation as a percentage of agricultural area in OIC countries (5.3%) is low when compared to non-OIC developing countries (7.3%) and the world average (6.1%). Since water resources in the OIC region are already under considerable pressure, the use of efficient irrigation systems and techniques becomes paramount. However, the available data on the irrigation techniques used in the OIC countries indicate that surface irrigation, which is the most traditional and most water-consuming technique, is by far the most widely used technique, practised in 81.7% of the total area equipped for irrigation. Consequently, huge amounts of the water diverted for irrigation in these countries are wasted at the farm level through either deep percolation or surface runoff. In contrast, sprinkler irrigation which is more water-saving than surface irrigation is practised in 4.1% of the total area equipped for irrigation in the OIC countries, and localized irrigation technique, which is the most water-saving technique, is practised in only 1.7% of the total area equipped for irrigation in the OIC countries. Prevalence of the localized irrigation technique also varies across countries within the OIC region. United Arab Emirates and Jordan stand out with their remarkably high levels in use of this technique, reaching 86.3% and 81.2%, respectively. In addition to these two countries, the percentage is more than 10% in only 5 OIC countries, namely, Tunisia (16.9%), Kuwait (13.4%), Benin (12.4%), Bahrain (11.6%) and Qatar (10.9%). In contrast, the percentage is negligible in 34 OIC countries (less than 0.1%).

Access to Water and Sanitation Services

The OIC Water Vision identifies access to water and sanitation services as one of the major challenges still facing many OIC countries with water supply and sanitation services coverage ranging from very low to very high, with some nations providing universal access for all regions, while in other nations coverage is poor and adequate household services limited to well-established urban areas.

The Millennium Development Goals "MDGs" sought to "halve the proportion of the population without access to safe drinking water and basic sanitation" between 1990 and 2015. In 2015, 83.7% of OIC member country populations had access to improved water, compared to average of 91.3% in non-OIC developing countries and close to 100% in developed countries. Among the OIC member countries, a total of 25 countries have met the MDG target of halving the proportion of people without access to sustainable improved water drinking sources. As for sanitation; the percentage of OIC population using improved sanitation went up from 43% in 1990 to 61.7% in 2015, compared to 62.4% in non-OIC developing countries close to 100% in developed countries. Out of the OIC member countries, a total of 16 countries have met the target, while the remaining did not achieve the target.

Moving from the MDGs to the SDGs; it is observed that the SDGs are more ambitious in terms of targets and in terms of scope. SDG 6.1 and SDG 6.2 call for access to all. They also go beyond providing access to improved water resources and sanitation facilities to achieving safely managed drinking water and sanitation services. Data on safely managed drinking water is available for 96 countries of which 19 are OIC countries. 71% of the global population used a safely managed drinking water while in OIC countries the percentage ranged from a high of 100% in Kuwait to a low of 6% in Uganda.

Data for safely managed sanitation services are available for 84 countries of which 19 are OIC Countries. 39% of the global population used safely managed sanitation services while the percentage in OIC countries ranged from a high of 100% in Kuwait to a low of 9% in Niger.

PART II: TRANSFORMING RISK INTO DIALOGUE AND COOPERATION

Water Security and Peace in the OIC

Population growth, rapid urbanisation, water-intensive patterns of growth and improved living standards, combined with the challenges of pollution, climate change, hydrologic variability, non-revenue water and changing ecosystems, negatively affects water security in many OIC countries. This paves the way to challenges for human health, the production of food and energy, industrial activity, the functioning of the national economy, as well as for the survival of animals, plants, and natural ecosystems.

The majority of OIC countries are consuming more of natural resources - such as water, land and forests, than nature can regenerate. Integrating nature-based solutions in water infrastructure planning and spending is essential. In addition, in many OIC countries, there is a huge difference between the amount of water put into the distribution system and the amount of water billed to consumers. Governments should reduce the loss of water in public networks through adequate monitoring and infrastructure development.

In last two decades, pollution levels increased into the severe pollution category in about 10-25 % of river stretches in Algeria, Burkina Faso, Djibouti, Egypt, Gambia, Iran, Mali, Morocco, Nigeria, Pakistan, Senegal, Somalia, Tunisia, Turkmenistan, Uganda and Uzbekistan. Some

countries are worse affected; in Bangladesh, Chad, Jordan, Kuwait, Lebanon, Palestine, Sudan, Syria and Yemen more than 25% of river stretches show increasing trends of severe pollution. The solution is not only to build more sewers but also to treat wastewater, and enable its usage by all relevant sectors.

Water is increasingly becoming a source of violent conflicts in the OIC region. During the period from 2010 to May 2018, fresh water in the OIC region was behind more violence than ever, with an increase to 67% of global water conflicts. However, around three-fourths of water incidents have occurred at the sub-national or local level rather than disputes among countries. On the other hand, the OIC region has seen a drastic upsurge in the number of signed international agreements on fresh water particularly in last four decades. However, if transboundary water cooperation is to have an impact, it must be active, dynamic and politically driven. It is particularly worrying that 47 of the 73 evaluated international watercourses in the OIC region have no appropriate cooperation frameworks in place.

Strengthening cooperation over fresh water will contribute to the capability of OIC countries to respond to many challenges, both strategically and politically. Strategically, it will bring additional opportunities for improved access to fresh water, better access to financial sources and will enable better use of good examples and experiences. From the political perspective, it will contribute to the improvement of bilateral and multilateral cooperation in the OIC region.

Implementation of the OIC Water Vision

The "OIC Water Council Survey 2018" aimed to gather information on implementation of the OIC Water Vision; identify the key water-related challenges facing OIC countries; and learn about the future actions and strategies to address these challenges. The survey also aimed to identify the training needs and capacities of member states and their financial requirements in terms of water infrastructure. As of August 2018, 15 OIC countries responded to the questionnaire, corresponding to 26% of OIC member countries with representation from all major geographical regions. The majority of respondents indicated that they had received the OIC Water Vision document and the implementation of various recommended actions and activities is in progress. Besides, they had also adopted, updated, and/or evaluated comprehensive national strategies and plans on water issues since the adoption of the OIC Water Vision in March 2012. In respect to major challenges, majority of the respondents listed ensuring access to water and sanitation services and water resource availability as major threats to their water security. A significant number of respondents singled out financing as a major obstacle facing them in the implementation of OIC Water Vision. Cooperation in the domain of water resources management is widely practiced among the respondents mainly through exchange programmes and trans-boundary water management activities. A significant number of respondents expressed their readiness to share their experiences in a range of water related fields through assistance in capacity building and technology transfer. In respect to capacity building and training needs, almost half of the respondents were willing to share their expertise through trainings in areas including integrated water resources

management and irrigation systems. On the other hand, majority of respondents listed water governance, wastewater recycling, desalination, and groundwater management as areas in which they require trainings. However, there was a difference in the prioritization of trainings needs on the part of respondents. Out of all the major training needs listed, majority of the respondents listed trainings in wastewater recycling and groundwater management as high priority. In regards to development assistance, more than half of the respondents lack financial means to build or upgrade necessary water infrastructure in their countries. Most of the infrastructure that needs building or upgrading in respondent countries is in the fields of irrigation, watershed and river systems management, and water supply and sanitation. Lastly, responding countries seemed to be well aware about their future challenges and more than half of them have strategies and commitments to achieve water security over the next 5-10 years. A large number of respondents reported impacts of changing physical climates and water resource availability as the main challenges facing their countries in the future. In order to successfully mitigate these challenges, respondents identified three main priorities that can ensure a water secure future: water governance (knowledge, regulations, and policies), access to finance, and improvement of water and sanitation services.

PART I: CURRENT STATE AND MAJOR TRENDS

CHAPTER ONE

Water Availability

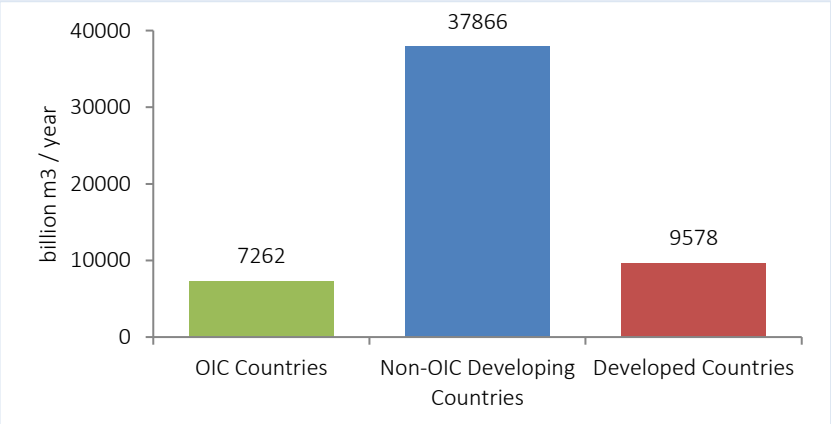
With over 70% of Earth's surface covered by water, the assumption would be that water is in abundance and the issue of water availability is of no relevance. However, 97.5% of all water on earth is salt water, leaving only 2.5% as fresh water – water that can theoretically be for used for drinking, hygiene, agriculture and industry. The majority of remaining fresh water (nearly 70%) is frozen in glaciers and ice caps in Antarctica and Greenland, thus rendering it inaccessible by humans.

Factors of natural and human nature affect the annual availability of water. Moreover, water volumes and their distribution over time and space are determined by climate and geomorphological conditions. The availability of water is significantly less than the water flowing into the system, and it fluctuates from time to time. This state of affairs highlights the importance of the issues of water availability and, thus, this chapter is devoted to examine the water resources, water availability, and means to increase water availability in OIC countries.

1.1 Renewable Water Resources

Renewable water resources are regenerated by precipitation. To measure renewable water resources, the indicator Total Renewable Water Resources (TRWR) is used. This indicator provides the long-term average water availability for a country in cubic kilometres (billion m^3) of precipitation, recharged ground water, and surface inflows from surrounding countries. Figure 1.1 shows the total renewable water resources (TRWR) in OIC countries in comparison to other country groups.

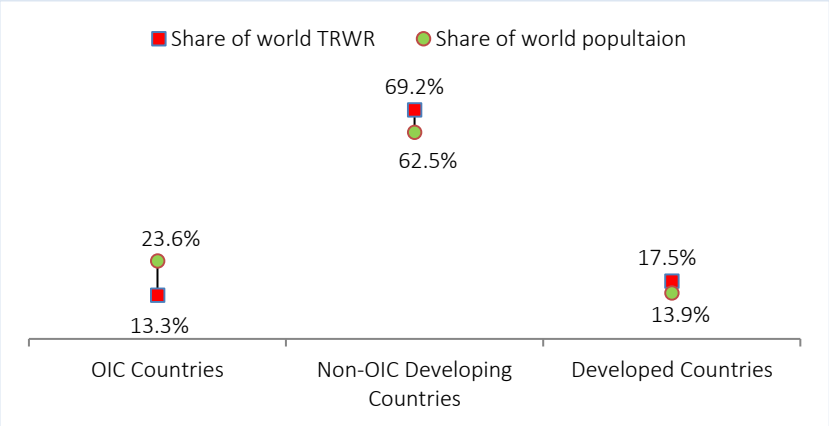
Figure 1.1: Total Renewable Water Resources (TRWR), 2013-2017



Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database.

Total renewable water resources are 7,262 billion m^3 in OIC countries, 37,866 billion m^3 in non-OIC developing countries and 9,578 billion m^3 in developed countries. Total renewable water resources in OIC countries are rather modest when compared to the OIC population as Figure 1.2 indicates.

Figure 1.2: Share of World TRWR and Population, 2013-2017

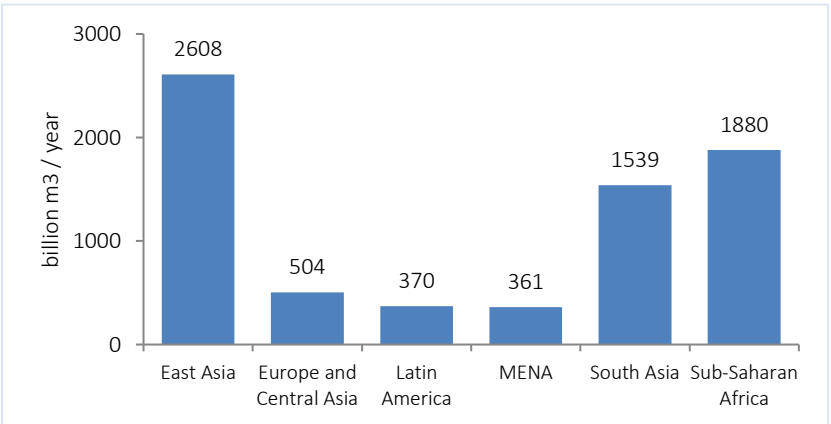


Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database and UN Population Division.

The share of OIC countries in the world's total renewable water resources is 13.3%, which is less than their share in the world total population of 23.6%. In contrast non-OIC developed countries and developed countries' share of the world's total renewable water resources are higher than their share of the world's population. Non-OIC developing countries share of the world's total renewable water resources is 69.2% while their share of the world's population is 62.5%. Also, developed countries share of the world's total renewable water resources is 17.5% while their share of the world's population is 13.9%.

Rainfall translates in river off and aquifer recharge, the two main sources of water; however, OIC countries have a large range of climates with high variability in rainfall. Some parts like East Asia and Bangladesh have high precipitation, while other parts like the Middle East and

Figure1.3: Total Renewable Water Resources (TRWR) in OIC Regions, 2013-2017

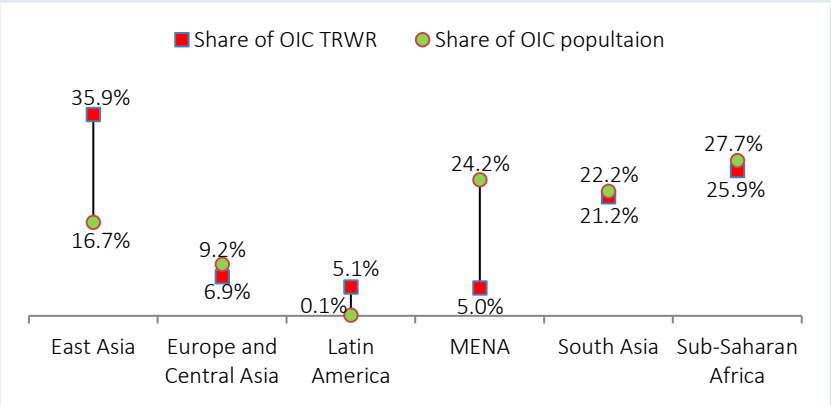


Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database.

North Africa has a very arid climate with closed hydrologic systems. On the high side there is Malaysia which enjoys an average precipitation of 2,875mm/year, while on the low side there is Egypt that has an average precipitation of 51 mm/year *(FAO AQUASTAT Online Data)*. The result is that water resources have a very uneven distribution among the OIC regions as shown in Figure 1.3.

The Figure shows that the highest amount of renewable water resources is observed in OIC countries in East Asia region with 2,608 billion m^3 while the lowest is observed in the OIC countries in the Middle East and North Africa (MENA) with a mere 361 billion m^3. To put the above figures into proper perspective it is useful to compare the total renewable water resources in OIC regions to the corresponding population in those regions as shown in Figure 1.4.

Figure 1.4: Share of OIC Regions in the OIC Total Population and TRWR, 2013-2017



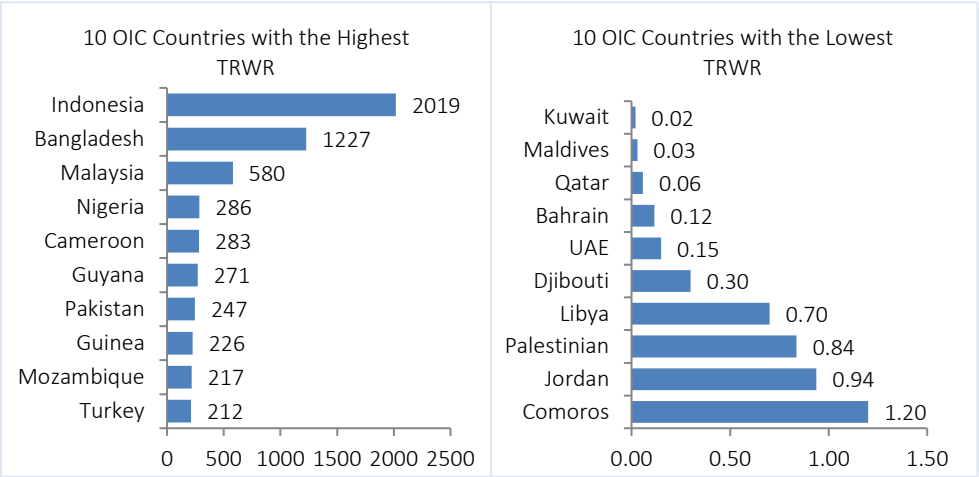
Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database and UN Population Division.

The Figure shows two sets of OIC regions. In one set; there are the OIC regions that have a share of renewable water resources higher than their share of the total OIC population. In this set there are OIC countries in East Asia that enjoy 35.9% of the total renewable water resources in the OIC countries while being home to only 16.7% of the total OIC population. OIC countries in East Asia are then followed by OIC countries in Latin America that possess 5.1% of the OIC total renewable water resource while being home to the very small fraction of 0.1% of the total OIC population. In the other set of OIC regions; the share of OIC total renewable water resources is less than the share of the total OIC population. This set is composed of the following: OIC countries in Europe and Central Asia (6.9% of OIC TRWR and 9.2% of OIC population), OIC countries in the Middle East and North Africa (5.0% of OIC TRWR and 24.2% of OIC population), OIC countries in South Asia (21.2% of OIC TRWR and 22.2% of OIC population), and OIC countries in Sub-Saharan Africa (25.9% of OIC TRWR and 27.7% of OIC population).

Likewise, the OIC regions shown in Figure 1.4 can be grouped according to the difference between their share of the OIC total renewable water resources and their share of the total OIC population. According to this grouping, three different sets of OIC regions are formed which are: minimal difference, moderate difference, and large difference. In the minimal difference set the countries share of the OIC total renewable water resources is a near match to their share of the OIC total population and this set of countries includes OIC countries in Europe and East Asia, OIC countries in South Asia, and OIC countries in Sub-Saharan Africa. The moderate difference set includes OIC countries in Latin America, and the large difference set includes OIC countries in East Asia and OIC countries in the Middle East and North Africa.

At the individual country level, water availability exhibits high variance among OIC countries as Figure 1.5 demonstrates.

Figure 1.5: OIC Countries with the Highest and Lowest Total Renewable Water Resources (TRWR, billion m^3/year), 2013-2017



Source: FAO AQUASTAT Online Database.

As the figure shows the highest amount of total renewable water resources is found in Indonesia (2.019 billion m^3/year) followed by Bangladesh (1.227 billion m^3/year) and Malaysia (580 billion m^3/year). On the other hand, it is observed that the majority of the OIC countries with the lowest amount of total renewable water resources are located in the Middle East and North Africa, such as Kuwait (0.02 billion m^3/year) and Qatar (0.06 billion m^3/year).

1.2 Non-Renewable Water Resources

Non-renewable, or fossil, water is the accumulated underground water which is the heritage of previous more humid climatic conditions that existed thousands of years ago. As Table 1.1 shows, OIC countries in the Middle East and North Africa and OIC countries in Sub-Saharan Africa are home to many of the world's major aquifers containing non-renewable water resources. Since these countries suffer from arid climates where renewable water resources

are limited, their non-renewable water resources or fossil water is considered an important strategic resource.

Table 1.1: Major Aquifers Containing Predominantly Non-Renewable Ground Water Resources

Country	Aquifer System	Extension (km2)	Exploitable Reserves (Mm^3)	Current Extraction (Mm^3/year)
Egypt, Libya, Sudan, Chad	Nubian Sandstone	2,200,000	14,460,000	2,170,000
Algeria, Libya, Tunisia	North Western Sahara	1,000,000	1,280,000	2,560
Algeria, Libya, Niger	Murzuk Basin	450,000	60 to 80,000	1,750
Mauritania, Senegal, Gambia	Maastrichtian	200,000	480 to 580,000	265
Mali, Niger, Nigeria	Lullemeden Multilayer Continental	500,000	250,000 to 2,000000	225
Niger, Nigeria, Chad, Sudan, Cameroon, Libya	Chad Basin	600,000	170 to 350,000	250
Saudi Arabia, Bahrain, Qatar, UAE	Various	225,000 to 250,000	500,000 to 2,185,000	13,790
Jordan (only)*	Al Disi Aquifer	3,000	6,250	170

Source: Adopted from UNESCO, 2006. Non-Renewable Ground Water Resources: A Guide book on Socially Sustainable Management for Water Policy Makers.

* Extends into Saudi Arabia, where it is included in the entry above

In the more arid climates of the Middle East and North Africa region, the use of non-renewable groundwater offers an opportunity to alleviate the limitation of renewable water resources, improve social welfare and facilitate economic development. It is for this reason that the global utilisation of non-renewable water resources is the highest in this region. Table 1.2 demonstrates the extent to which the OIC countries located in this region are reliant on non-renewable ground water resources.

As the table clearly demonstrates, the global mining of non-renewable groundwater is concentrated in Saudi Arabia and Libya, which together account for 77% of the estimated total world extraction of non-renewable groundwater. In the arid areas of the Middle East and North Africa, groundwater is a source of life and is used for both urban water supply and for irrigated agriculture. However, unplanned depletion of non-renewable groundwater reserves can undermine, and potentially erode, the economic and social vitality of OIC countries in the Middle East and North Africa. The challenge for these countries is to find a balance between preservation and use. Thus the need to plan the utilisation of non-renewable water resources and the preparation for dealing with water stress as aquifer storage is depleted becomes paramount.

Table 1.2: Exploitation of Non-Renewable Ground Water Resources

Country	Year(s) of Estimate	Groundwater (Mm^3/year)		
		Share of Demand*	Total Use	Non-Renewable
Algeria	2000	54%	2,600	1,680
Saudi Arabia	1999 (1996)	85%	21,000	17,800
Bahrain	1999 (1996)	63%	258	90
Egypt	1999 (2002)	7%	4,850	900
UAE	1999 (1996)	70%	900	1,570
Jordan	1999 (1994)	39%	486	170
Libya	1999	95%	4,280	3,014
Oman	1999 (1991)	89%	1,644	240
Qatar	1999 (1996)	53%	185	150
Tunisia	2000	59%	1,670	460
Yemen	1999 (1994)	62%	2,200	700

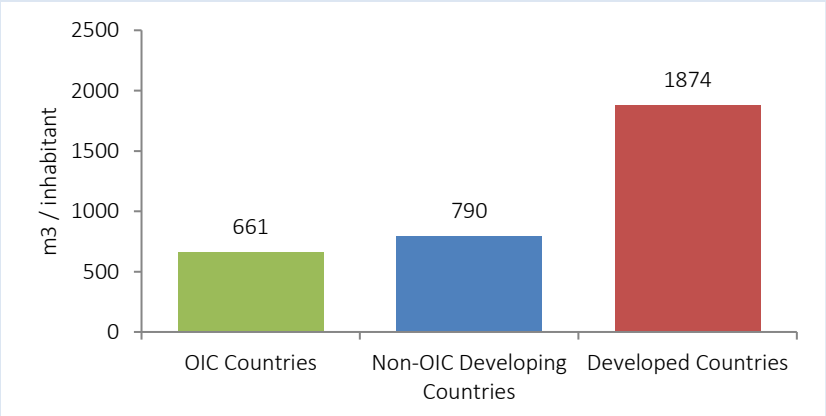
Source: Margat (1995, 1998, 2000), UN-FAO (1997), UN-ECSWA (1999) – as cited in UNESCO, 2006.

* Proportion of the total actual water demand met from underground water

1.3 Dam Capacity

Water availability is not restricted to natural factors; human factors play an important role in determining water availability. Thus, specific human interventions can have a role in increasing water availability. Water storage whether especially in the conventional method of dams increase the availability of water on a regular basis and especially in dry seasons were otherwise water would have been absent. Also, water storage is a prerequisite for allowing the transfer of water from high precipitation regions to low precipitation regions. Furthermore, dams provide hydropower and provide some level of protection from extreme precipitation events that otherwise would result in floods. Dams may also allow for the excess

Figure 1.6: Dam Capacity per Capita, 2003-2017

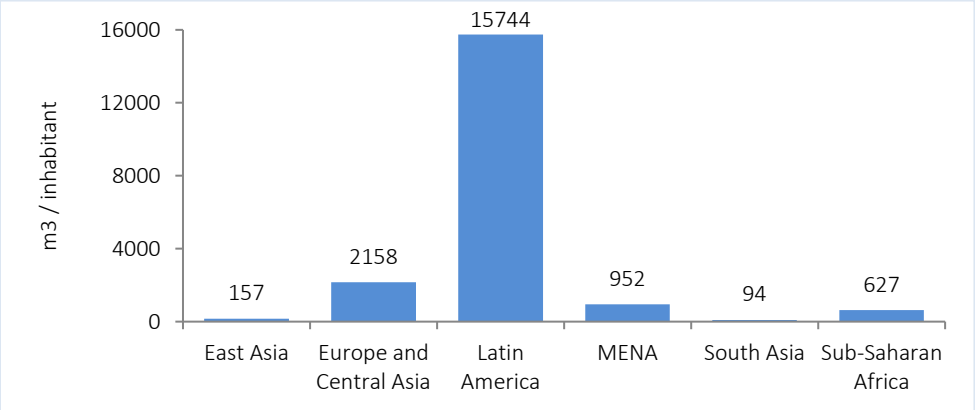


Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database and UN Population Division.

runoff that would normally flow to the ocean without being used to become available for use.

Figure 1.6 shows the total cumulative storage capacity of dams per capita in OIC countries in comparison to other country groups.The values in the Figure indicate the sum of the theoretical initial capacities of all dams, which does not change over time. The amount of water stored within any dam is likely less than the capacity due to silting. Data on small dams may not be included, although their aggregate storage capacity is generally not significant. As the figure shows, dam capacity in OIC countries stands at 661 m^3/inhabitant, which is lower than the 790 m^3/inhabitant observed in non-OIC developing countries and significantly lower than that observed in developed countries (1871 m^3/inhabitant).

Figure 1.7: Dam Capacity per Capita in OIC Regions, 2003-2017



Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database and UN Population Division.

Dam capacity per capita varies greatly among OIC regions as Figure 1.7 clearly demonstrates. OIC countries in Latin America, namely Suriname and Guyana, that enjoy relatively plentiful water resources and small populations; have very high dam capacity per capita (15,744 m^3/inhabitant.) They are followed by OIC countries in Europe and Central Asia with an average dam capacity of 2,158 m^3/inhabitant and OIC countries in the Middle East and North Africa with an average dam capacity of 952 m^3 per inhabitant. The lowest dam capacities per capita are observed in OIC countries in south Asia with a mere average dam capacity of 94 m^3/inhabitant, followed by OIC countries in East Asia (157 m^3/inhabitant) and finally OIC countries in Sub-Saharan Africa (627 m^3/inhabitant).

1.4 Water Dependency

One issue related to water availability that has strategic and security implications is the source of available water. Water can be generated from within the borders of a country (internal water resource) or can be trans-boundary in nature meaning that it originates from outside the boarders of a country (external water resources). While holding a potential for conflict and disagreements, trans-boundary water provides opportunities for cooperation and promotion of regional peace and security as well as economic growth.

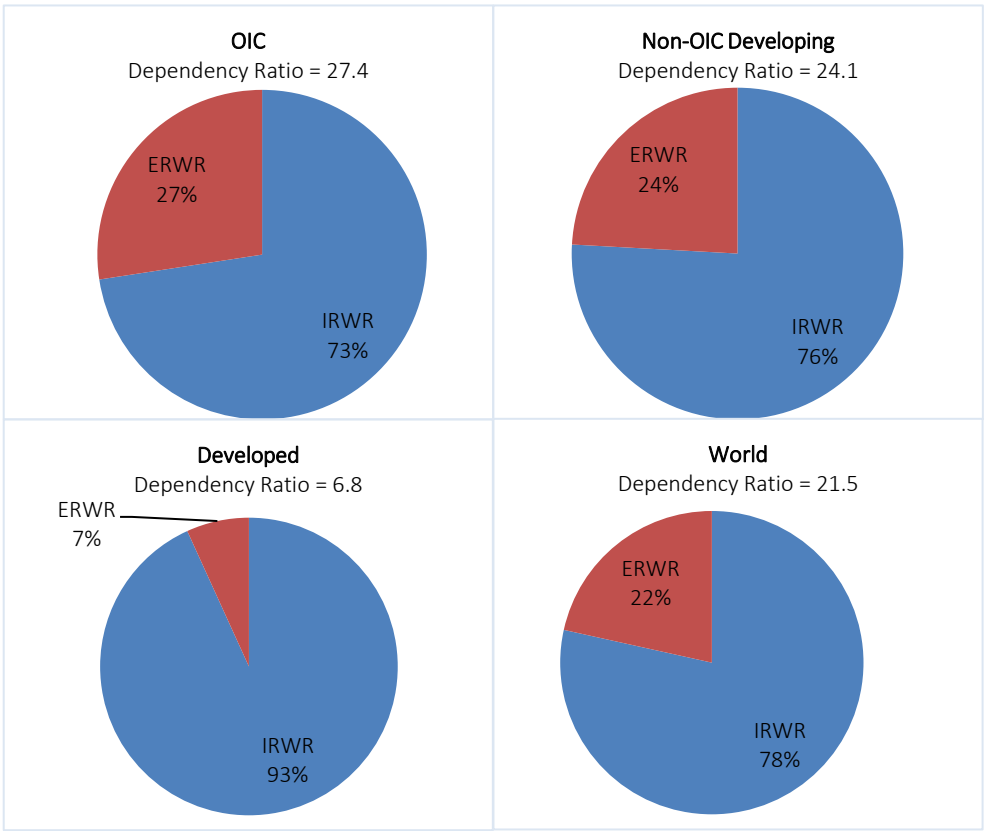
Water dependency is measured by dividing external renewable water resources (ERWR) by the total renewable water resources (TRWR), where the total renewable water resources are the summation of both internal renewable water resources (IRWR) and external renewable water resources (ERWR). In equation form, water dependency is given as follows:

$$Water\ Dependency\ Ratio = \frac{ERWR}{IRWR + ERWR} \times 100$$

Water dependency may theoretically vary between 0 and 100. A country with a dependency ratio equal to 0 does not receive any water from neighbouring countries. A country with a dependency ratio equal to 100 receives all its renewable water from upstream countries, without producing any of its own.

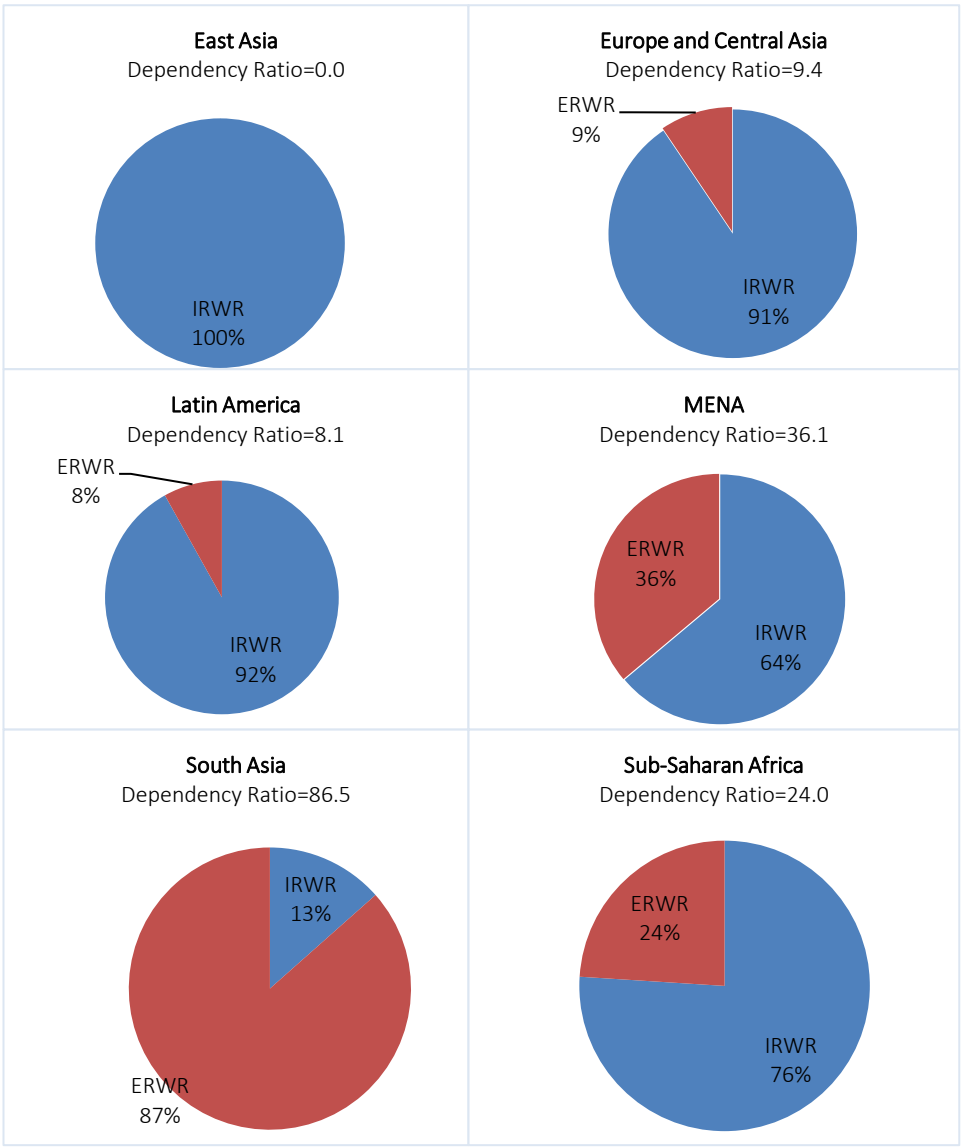
OIC experiences a higher degree of water dependency when compared with other country groups as shown in Figure 1.8. In OIC countries, 73% of total renewable water resources are generated internally while 27% are generated externally, thus resulting in a dependency ratio of 27.4, which is higher than the 24.1 observed in non-OIC developing countries and the 6.8 ratio observed in developed countries.

Figure 1.8: Water Dependency, 2013-2017



Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database.

Figure 1.9: Water Dependency in OIC Regions, 2013-2017

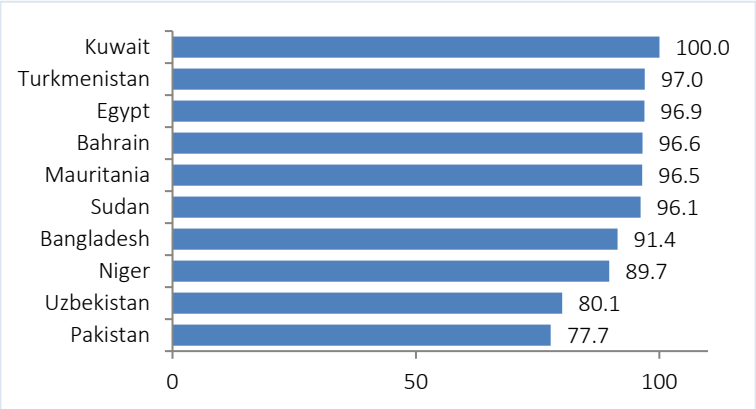


Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database.

The highest level of water dependency is observed in OIC Countries in South Asia (86.5) followed by OIC countries in the Middle East and North Africa (36.1) and OIC countries in Sub-Saharan Africa (24.0). On the opposite side of the scale, OIC countries in East Asia are totally independent when it comes to water resources. OIC countries in Latin America and OIC Countries in Europe and Central Asia exhibit relatively low degrees of water dependency having dependency ratios of 8.1 and 9.4 respectively (Figure 1.9).

At the individual country level, water dependency varies widely with some countries highly dependent on external waters and other totally water-independent. As Figure 1.10 shows, Kuwait has the highest level of water dependency. Kuwait is followed by Turkmenistan that has a water dependency ratio of 97.0 and Egypt that has a water dependency ratio of 96.9.

Figure 1.10: 10 OIC Countries with the Highest Degree of Water Dependency, 2013-2017



Source: FAO AQUASTAT Online Database.

Table 1.3: OIC Countries with the Lowest Degree of Water Dependency

OIC Countries with Zero Dependency Ratios		
Brunei Darussalam	Comoros	Djibouti
Guinea	Indonesia	Libya
Malaysia	Maldives	Morocco
Oman	Saudi Arabia	Sierra Leone
Suriname	United Arab Emirates	Yemen
Zero <OIC Countries with Dependency Ratios < 5		
Lebanon	Kyrgyzstan	Gabon
Turkey	Palestine	Qatar
Cameroon	Algeria	
5 <OIC Countries with Dependency Ratios < 10		
Iran	Burkina Faso	Côte d'Ivoire
Tunisia		

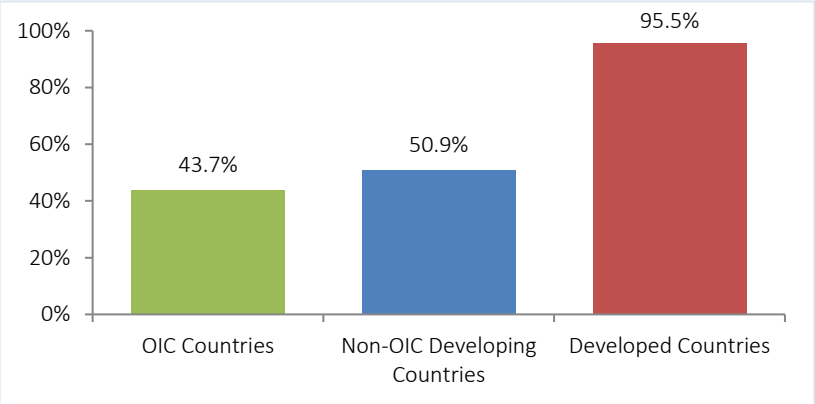
Source: FAO AQUASTAT Online Database.

In contrast, many OIC countries have low water dependency ratios. These countries are listed in Table 1.3.

1.5 Waste Water

Water availability can be enhanced through the import of water into a system. The main options for importing water into a system include: inter-basin transfers, desalinisation of sea water and the use of waste water. Waste water is comprised of domestic grey-water (water from baths, sinks, washing machines, and kitchen appliances) and black-water (water from toilets), as well as industrial wastewater that may have additional chemical contaminants. The use of waste water requires the treatment of collected waste water, and in this regard OIC countries have a large opportunity to improve as illustrated by Figure 1.11.

Figure 1.11: Proportion of Collected Waste Water that is Treated, 2018

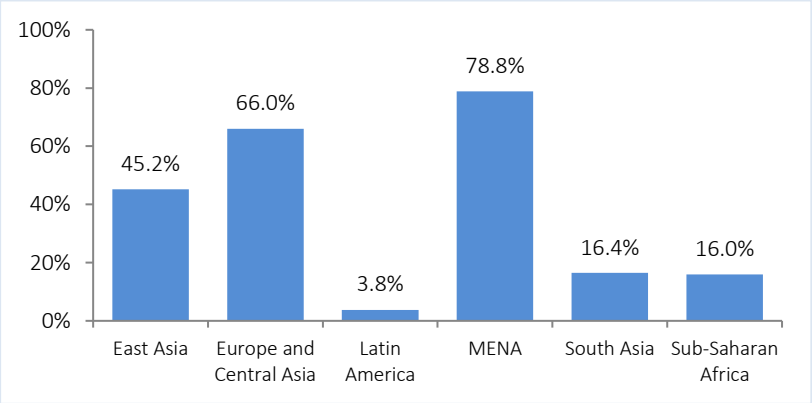


Source: SESRIC Staff Calculations based on Yale University 2018 Environmental Performance

The values in Figure 1.11 are a measure of wastewater treatment as the percentage of wastewater that undergoes at least primary treatment in each country, normalized by the proportion of the population connected to a municipal wastewater collection system. In OIC countries, the proportion of collected wastewater that is treated is only 43.7%. This proportion is lower than the 50.9% observed in non-OIC developing countries and it seriously lags behind that in developed countries where 95.5% of collected wastewater is treated.

At the OIC regional level, the proportion of collected waste water that is treated is 78.8% in OIC countries located in the Middle East and North Africa and this percentage is the highest among OIC regions (see Figure 1.12) The second and third highest proportions of collected waste water that is treated are found in OIC countries located in Europe and Central Asia (66.0%) and OIC countries located in East Asia (45.2%) respectively. In the remaining OIC regions, the proportion of collected wastewater that is very low. To be more specific; the proportion of collected waste water that is treated in OIC countries located in Latin America is 3.8%, in OIC countries located in Sub-Saharan Africa is 16.0% and in OIC countries located in South Asia is 16.4%.

Figure 1.12: Proportion of Collected Waster Water that is Treated in OIC Regions, 2018



Source: SESRIC Staff Calculations based on Yale University 2018 Environmental Performance

By increasing their wastewater treatment capacities, OIC countries can increase water availability. In addition to increasing water availability, the practice of wastewater treatment contributes to the health of aquatic systems and provides health benefits for local residents.

CHAPTER TWO

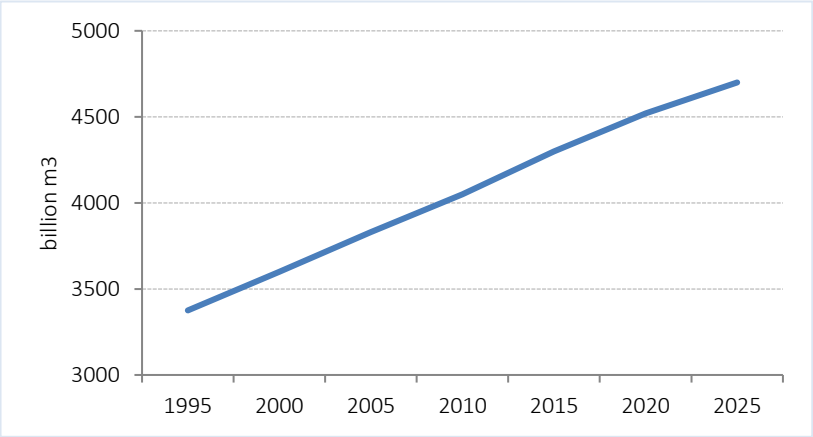
Water Demand

If oil was the strategic commodity of the 20th century, then probably water stands to replace it as the commodity of the 21st century. The demand for water has been increasing steadily and does not show signs of relenting, and this in turn is placing unprecedented pressure on water resources. Factors driving water demand are all anthropogenic (human) by nature. Population growth and consumerism (as a social and economic order, and as an ideology that encourages the acquisition of goods and services in ever-increasing amounts) directly increase demand for goods and services, and the water associated with their production, processing and delivery. This increased demand is observed across all water using sectors; namely, agricultural sector, industrial sector and the municipal sector. Against this backdrop this chapter starts off by discussing factors driving the demand for water before moving on to discussing water withdrawals and pressure on water resources before concluding with the subject of managing water demand.

2.1 Factors Driving the Demand for Water

The upward trend in water demand is projected to continue into the foreseeable future as Figure 2.1 reveals. The values in the figure are based on FAO's AQUASTAT database and assume the Business as Usual Scenario (BAU). The BAU scenario in essence assumes that the water use patterns will not change.

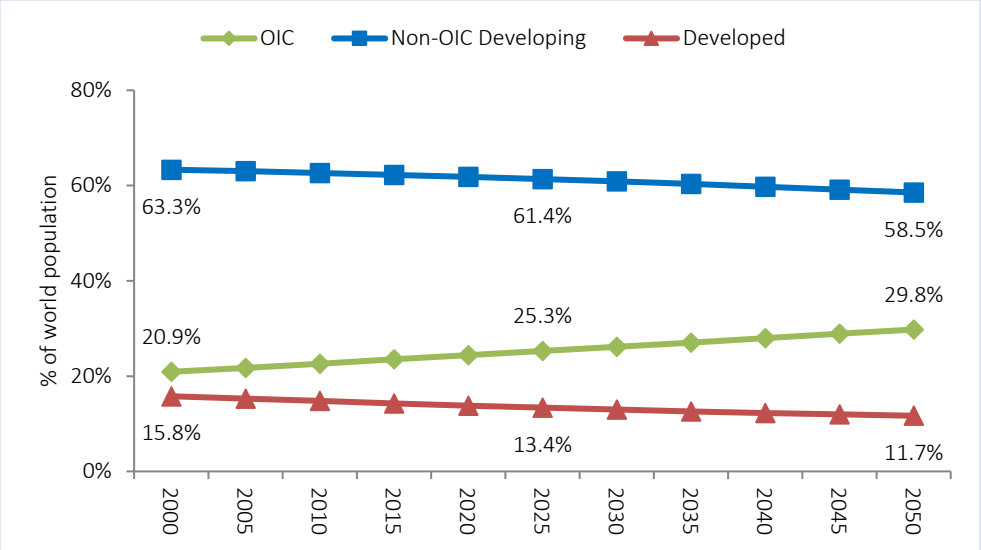
Figure 2.1: Water Demand Trends



Source: Adopted from IWMI, 2014

At the forefront of factor driving the demand for water is population growth. World population is projected to increase by 1.2 billion people in the next 15 years from an estimated 7.3 billion people in 2015 to 8.4 billion people in 2030 (Based on the UN Population Division's estimates and projections). The increase in water demand driven by population growth is of high relevance to OIC countries in particular since the rate of population growth in OIC countries outpaces that in other country group as show in Figure 2.2.

Figure 2.2: Trends in World Population, 2000-2050



Source: SESRIC Staff Calculations based on UN Population Division Estimates and Projections

The figure shows that the share of OIC countries in world population is continuously increasing from an estimated 20.9% in the year 2000 to a projected 25.3% in the year 2025 and 29.8% in the year 2050. In contrast, the share of non-OIC developing countries and developed countries in the world population is in steady decline. The share of non-OIC developing countries in the world population is projected to decline from 63.3% in the year 2000 to 61.4% in the year 2025 to 58.5% in the year 2050. As for developed countries, their share in the world population is projected to decline from 15.8% in the year 2000 to 13.4% in the year 2025 to 11.7% in the year 2050. These figures highlight the demographic pressure on water resources in OIC countries.

Population growth is not the only factor which drives demand for water as evident by the fact that water demand has been growing at more than twice the rate of population increase in the last century (FAO, 2008.) As incomes increase and economies grow so does the demand for water. The increase in water demand is across the board; from municipal, to agriculture to industrial use. Income increase and economic growth leads to increased production and consumption of manufactured good, electric power, and services all of which raise demand for water. Also as incomes increase, people diets undergo significant changes. People start eating more meat and dairy product which require more water to produce than a diet based on staple crops (i.e. cereals). It is expected that the global average food supply will rise from 2650 kcal/person/day in 2006 to above 3000 kcal/person/day in 2050. These per-capita figures translate into an additional one billion tonne of cereals and 200 million tonnes of meat to be produced annually (Bruinsma, 2009).

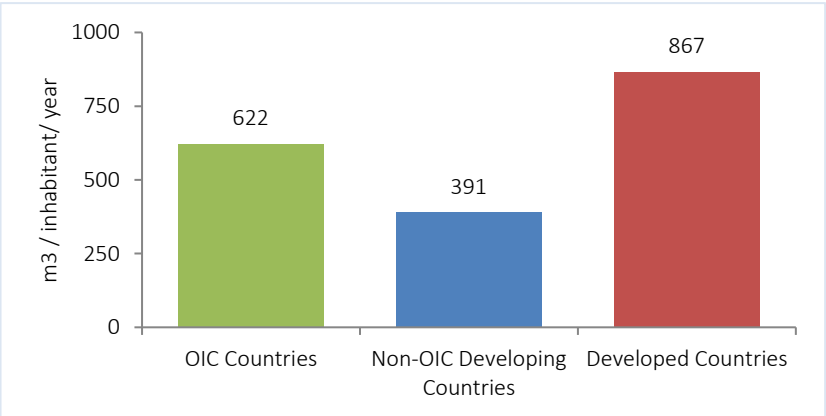
Another factor driving water demand is urbanization. The urbanization factor is of high relevance to developing countries which are experiencing higher rates of urbanization when compared to developed countries. As urbanization increases so does the length of the food chain which results in more food wastage. It is estimated that global agricultural production would need to grow by 60 % between 2006 and 2050 to keep up with food demand and that both the proportion of cropland under irrigation, and the share of irrigated production will increase, resulting in greater demand for agricultural water (Bruinsma, 2009).

2.2 Water Withdrawal

Total water withdrawal, as a proxy to measure the demand for water, reflects the annual quantity of water withdrawn for agricultural, industrial and municipal purposes. It includes renewable freshwater resources, as well as potential over-abstraction of renewable groundwater or withdrawal of fossil groundwater, and potential use of desalinated water or treated wastewater. It does not include in stream uses, which are characterized by a very low net consumption rate, such as recreation, navigation, hydropower, inland capture fisheries, etc.

Figure 2.3 shows the annual total water withdrawal per capita in OIC countries in comparison with country groups.

Figure 2.3: Annual Total Water Withdrawal per capita, 2003-2017

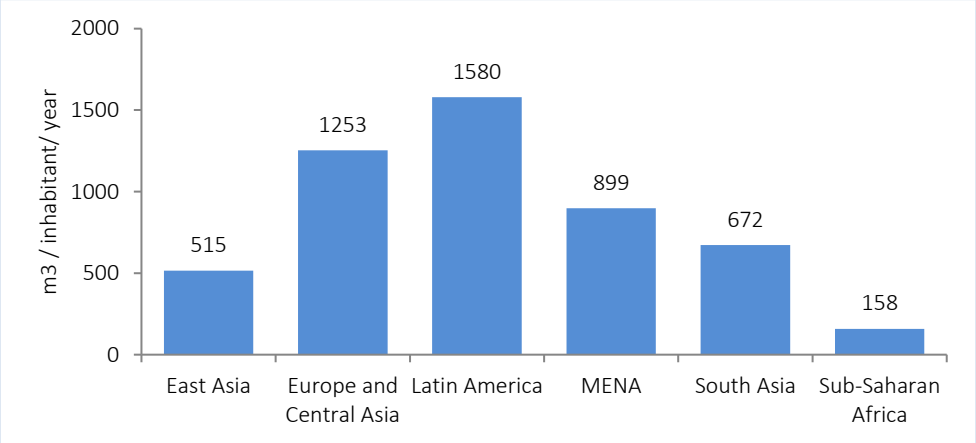


Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database. Data weighted by country populations.

The demand for water in OIC countries far exceeds that in non-OIC developing countries but is still significantly lower than that observed in developed countries. As Figure 2.3 shows, the annual total water withdrawal per capita in OIC countries is 622m^3/inhabitant/year; while in non-OIC developing countries it is 391m^3/inhabitant/year, and in developed countries it is 867m^3/inhabitant/year.

OIC regions shows large variances in their annual total water withdrawal per capita (Figure 2.4) and this is a reflection of many factors such as: income level, economic development level, availability of water resources and consumption behaviours.

Figure 2.4: Annual Total Water Withdrawal per capita in OIC Regions, 2003-2017



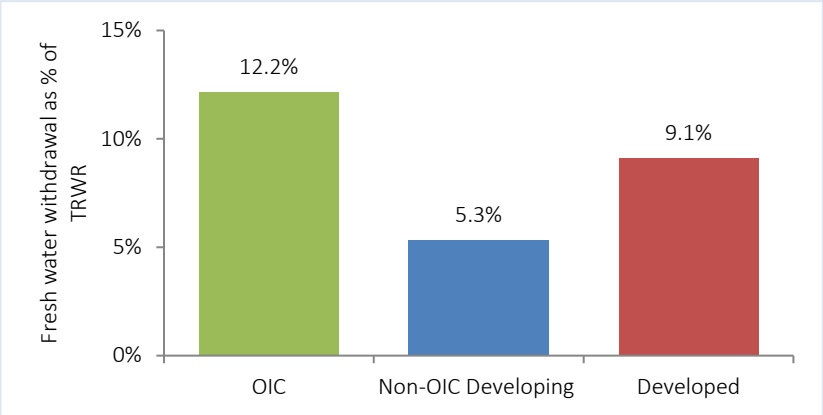
Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database. Data weighted by country populations.

OIC countries in Latin America record the highest level of annual total water withdrawal per capita (1580m^3/inhabitant/year). Next in line are OIC countries in Europe and Central Asia with an annual total water withdrawal per capita of 1253m^3 and OIC countries in the Middle East and North Africa with 899m^3. The lowest annual total water withdrawal per capita is observed in OIC countries in Sub-Saharan Africa with a mere 158m^3 followed by OIC countries in East Asia with 515m^3 and OIC countries in South Asia with 672m^3.

2.3 Pressure on Water Resources

The demand for water is continuously increasing as was demonstrated in section 2.1. The increased demand for water puts pressure on the existing water resources. Total freshwater withdrawal (TFWW) in a given year, expressed in percentage of the actual total renewable water resources (TRWR) is used as an indication of the pressure on the renewable water resources. Figure 2.5 shows the level of pressure on water resources in OIC countries in comparison with other country groups.

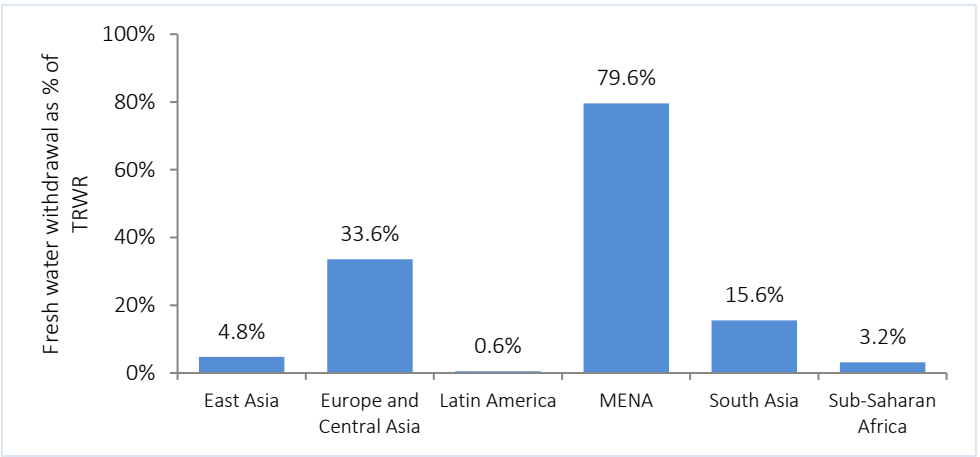
Figure 2.5: Pressure on Water Resources, 2003-2017



Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database. Data weighted by country populations.

The pressure on water resources in OIC countries far exceeds all other country groups. In OIC countries, fresh water withdrawal as a percentage of total renewable water resources is 12.2% compared to 5.3% in non-OIC developing countries and 9.0% in developed countries. As expected, the highest pressure on water resources is observed in OIC countries located in the arid and dry region of the Middle East and North Africa, where fresh water withdrawal as a percentage of total renewable water resources reached an alarming value of 79.6% (Figure 2.6). Next in line are OIC countries in Europe and Central Asia with pressure on water resources recorded at 33.6% and OIC countries in South Asia with 15.6%. On the other hand, OIC countries in Latin America, Sub-Saharan Africa and East Asia recorded low pressure levels on water resources of 0.6%, 3.2% and 4.8%, respectively.

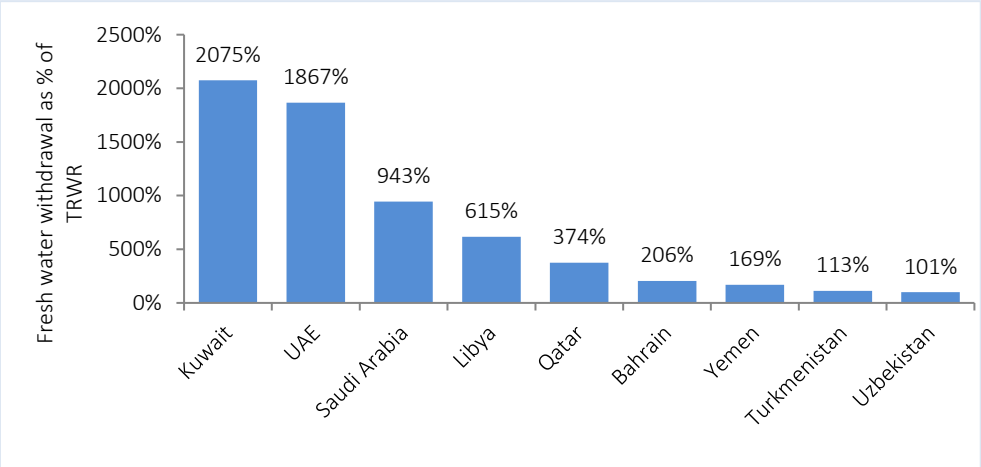
Figure 2.6: Pressure on Water Resources in OIC Regions, 2003-2017



Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database. Data weighted by country populations.

As shown in Figure 2.7, fresh water withdrawals in nine OIC countries exceed their total renewable water resources. All of these countries are located in either the Middle East and North Africa region or in the Central Asia Region. The highest pressure on water resources is observed in Kuwait where fresh water withdrawal exceeds more than 20 times the amount of total renewable water resources in the country. Kuwait is followed by the United Arab Emirates where fresh water withdrawal as a percentage of total renewable water resources is a whopping 1867% and Saudi Arabia 943%.

Figure 2.7: OIC Countries with Pressure on Water Resources Exceeding 100%



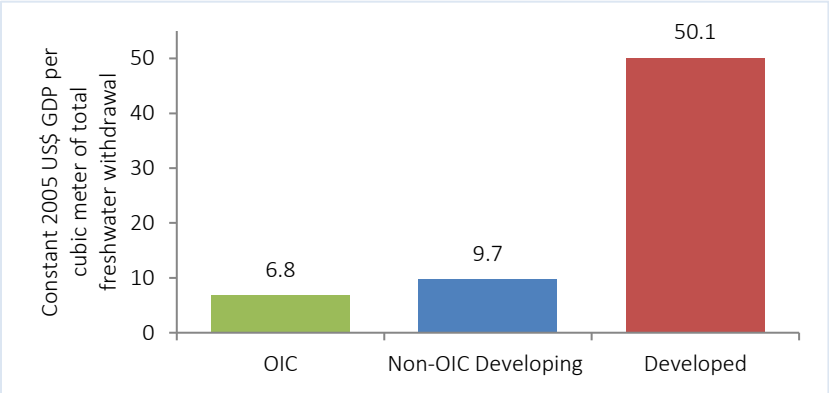
Source: FAO AQUASTAT Online Database.

2.4 Water Productivity

There are two vital and interrelated activities that are of great importance to the issue of managing water demand; namely the improvement in technical efficiency of water use and the efficient allocation of available water among competing uses. Improvements in the efficiency of water use and its allocation are usually undertaken by water providers and water users with the different water using sectors, namely: agriculture, industrial and municipal. By meeting the needs of water users using less water, significant quantities of water can be freed up.

As illustrated in Figure 2.8, water productivity is very low in OIC countries compared to other country groups where each one cubic meter of total freshwater withdrawal corresponds to 6.8 US$ of GDP. This compares poorly with water productivity in non-OIC developing countries where GDP per cubic meter of total freshwater withdrawal equals 9.7 US$, and is astronomically behind the level of 50.1 US$ recorded in the developed countries.

Figure 2.8: Water Productivity

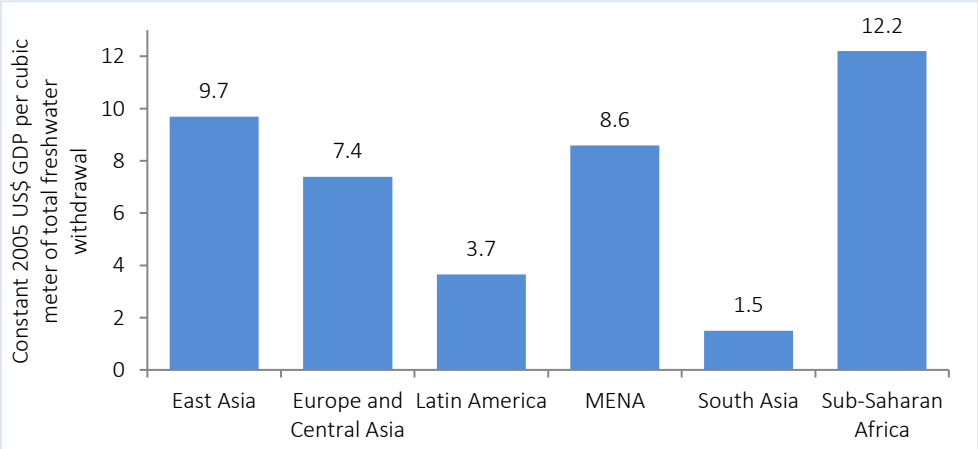


Source: SESRIC Staff Calculations based on World Bank WDI Online Database. Data weighted by country GDP and Fresh Water Withdrawals. Data available for 167 countries of which 53 are OIC member states. Latest available data between 2003 and 2017 used in calculation.

A significant level of variability among OIC regions has been observed in terms of water productivity. As Figure 2.9 shows, OIC countries in Sub-Saharan Africa recorded the highest water productivity among OIC regions, followed by OIC countries in East Asia and OIC countries in Middle East and North Africa. In Contrast, OIC countries in South Asia recorded the lowest water productivity among OIC regions followed by OIC countries in Latin America and OIC countries in Europe and Central Asia.

The state of affairs indicates that OIC countries have a large opportunity to improve their water productivity through, inter alia, increasing the technical efficiency of water use and efficiently allocating available water among competing uses.

Figure 2.9: Water Productivity in OIC Regions



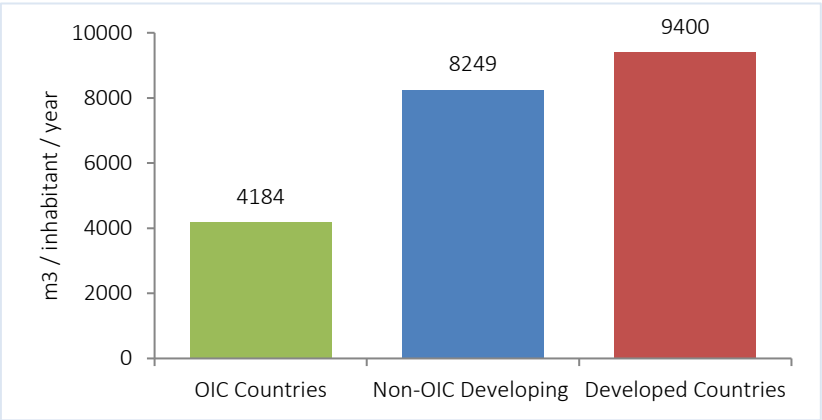
Source: SESRIC Staff Calculations based on World Bank WDI Online Database. Data weighted by country GDP and Fresh Water Withdrawals. Data available for 53 OIC member states. Latest available data between 2003 and 2017 used in calculation

2.5 Water Scarcity

There are many active discussions on how to measure water scarcity. The most widely used indicator of water scarcity is the total renewable water resources (TRWR) per capita. Based on this indicator, the threshold values of 500, 1,000 and 1,700 m^3/inhabitant/year are used to distinguish between different levels of water scarcity (Falkenmark and Widstrand, 1992). Total annual renewable water resources that are less than 500m^3 per capita indicate *absolute water scarcity*. Values between 500 and 1000 signify *chronic water shortages*. Values between 1,000 and 1,700 point to *regular water stress*; whereas, values large than 1,700 indicate *Occasional or local water stress*.

Figure 2.10 shows annual total renewable water resources per capita for OIC countries in comparison with other country groups. As groups, none suffers from water scarcity where annual total water resources per capita in all country groups exceed 1,700m^3. Nonetheless, as will be shown later in this section, many regions and countries suffer from water scarcity. Among the country groups shown in Figure 2.10, the group of OIC countries is the closest to the water scarcity thresholds. OIC countries recorded an average value of 4,184m^3 of total renewable water resources per inhabitant per year, a rate which is significantly lower than that observed in non-OIC developing countries (8,249m^3 per inhabitant per year) and developed countries (9,400m^3 per inhabitant per year).

Figure 2.10: Water Scarcity (TRWR per capita), 2013-2017

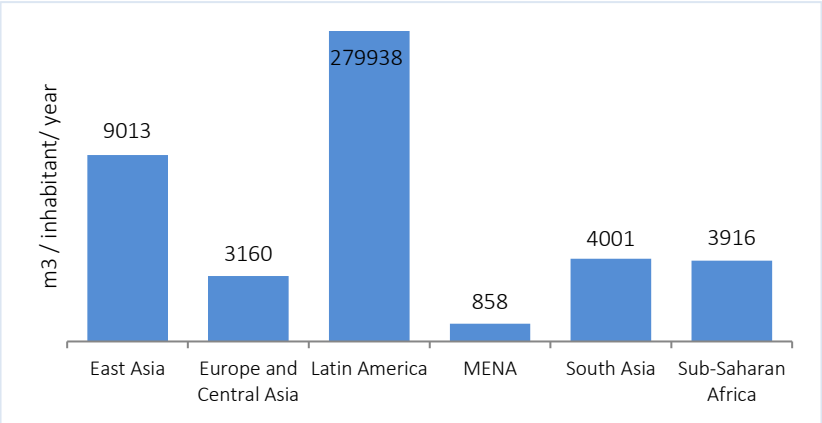


Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database. Data weighted by country populations.

At the OIC regional level, water scarcity is a fact of life in the arid and dry region of the Middle East and North Africa. As shown in Figure 2.11, OIC countries in this region have average annual total renewable water resources that stand at 858m^3 per capita, a rate which is below the threshold of 1,000m^3, and this puts them among the countries facing chronic water shortages. OIC countries in Europe and Central Asia, OIC countries in Sub-Saharan Africa and OIC countries in South Asia all have limited average annual total renewable water resources

per capita recorded, respectively at 3,360m^3, 3,916m^3 and 4,001m^3. On the other hand, OIC countries in Latin America are endowed by an abundance of water resources. The average annual total renewable water resource per capita in these countries is measured at 279,938m^3. Next in line are OIC countries in East Asia with average annual total renewable water resources per capita of 9,013m^3.

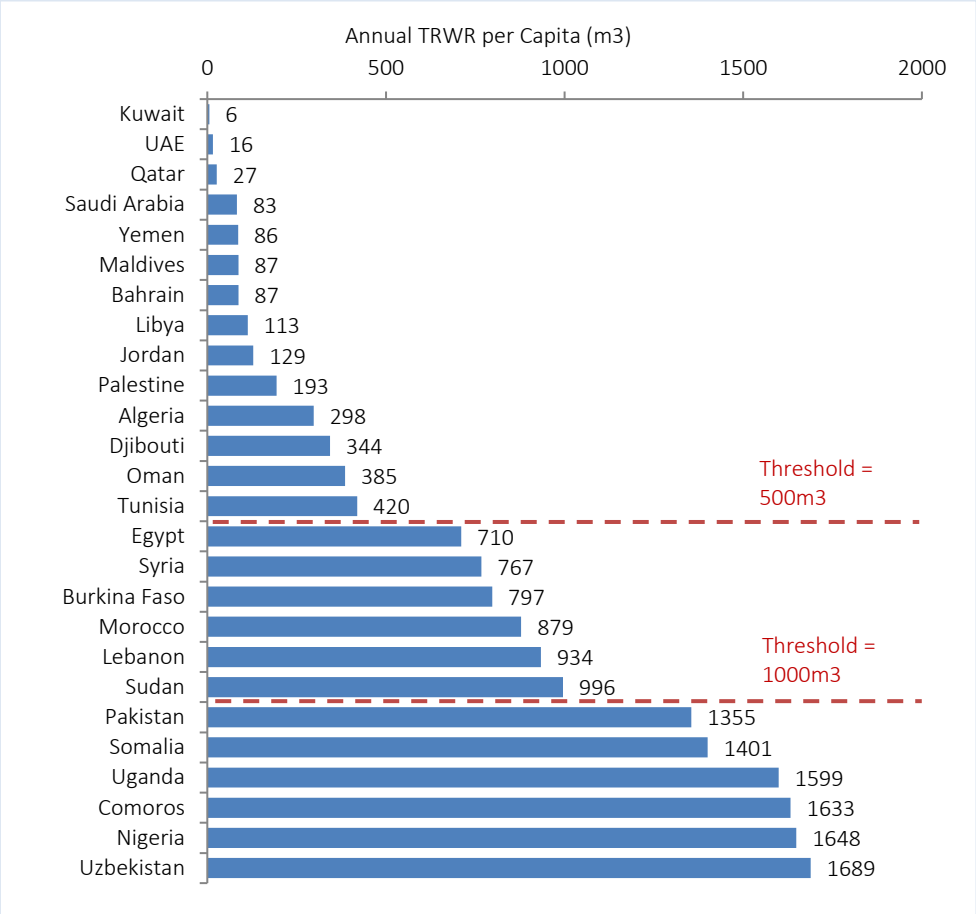
Figure 2.11: Water Scarcity (TRWR per capita) in OIC Regions, 2013-2017



Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database. Data weighted by country populations. Graph drawn not to scale.

At the individual country level, the issue of water scarcity is bleak with many OIC countries suffering from different levels of water scarcity. As Figure 2.12 reveals, almost half of OIC countries face some level of water scarcity. Absolute water scarcity is observed in 14 OIC countries, namely Kuwait, United Arab Emirates, Qatar, Saudi Arabia, Yemen, Maldives, Bahrain, Libya, Jordan, Palestine, Algeria, Djibouti, Oman and Tunisia. Chronic water shortages are observed in six OIC countries, namely Egypt, Syria, Burkina Faso, Morocco, Lebanon and Sudan. Finally, six OIC countries experience regular water stress, namely Pakistan, Somalia, Uganda, Comoros, Nigeria and Uzbekistan.

Figure 2.12: OIC Countries Suffering from Water Scarcity, 2013-2017



Source: FAO AQUASTAT Online Database. Latest available data between 2000-2014.

CHAPTER THREE

Balancing Water Use and Food Production

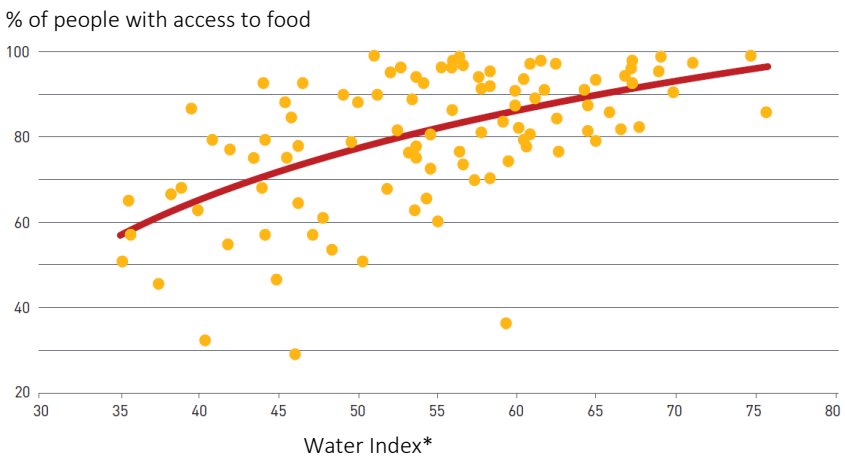
One of the major issues that are relevant to human and economic development is how to manage water resources to meet the rising demand for food while at the same time meeting the demand from industrial and municipal use. This chapter examines the linkages between water and food security and highlights the issue of competition for water resources among different water using sectors before concluding with the topic of irrigation in agriculture.

3.1 Linkages between Water and Food Security

OIC countries' population will increase from an estimated 1.74 billion in 2015 to an estimated 2.07 billion in 2025 to 2.91 billion in 2050 (*SESRIC staff calculations based on UN Population Division Estimates and Projections*). The increase in population coupled with economic progress will translate in increased demand for food. Yet, as it has been shown earlier in this report, water resources which are the base of food production are limited and already under pressure in many OIC countries. Thus, ensuring access to water, especially, for the agriculture sector is of paramount importance to food security.

If water is the key to food security, then its absence is the cause of undernourishment and famine. As Figure 3.1 illustrates, the water index is positively correlated with the percentage of people with access to food; that is, as the water index increase, the percentage of people with access to food increases, and vice versa, as the water index decrease a lower percentage of people gain access to food.

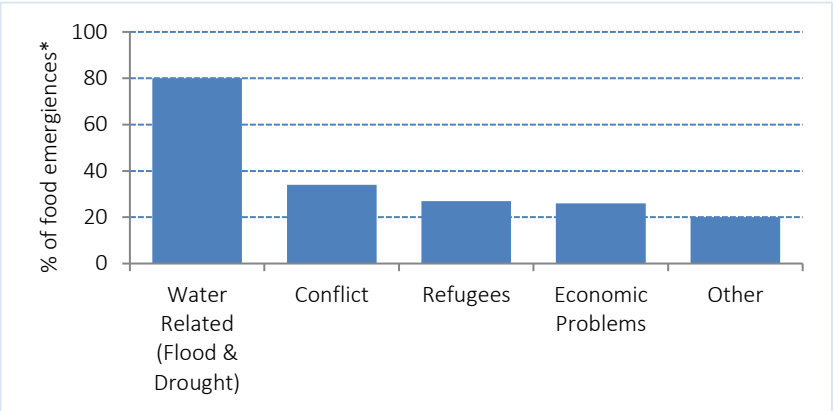
Figure 3.1: Access to Water and Food Security (developing countries and countries in transition)



Source: FAO, CEH Wallingford
**A composited indicator that incorporates measures of water resources (from rainfall, river flows and aquifer recharge), access, environmental issues (water quality) and pressure on resources*

Water is also linked to food security from another dimension which is food emergencies. As Figure 3.2 illustrates, water related events outstrips conflict, refugees and economic problems as the cause of food emergencies in developing countries. Erratic rainfall and sessional variability in water availability result in floods and droughts, which lead to the most severe incidents of food emergencies.

Figure 3.2: Causes of Food Emergences in Developing Countries, 2002



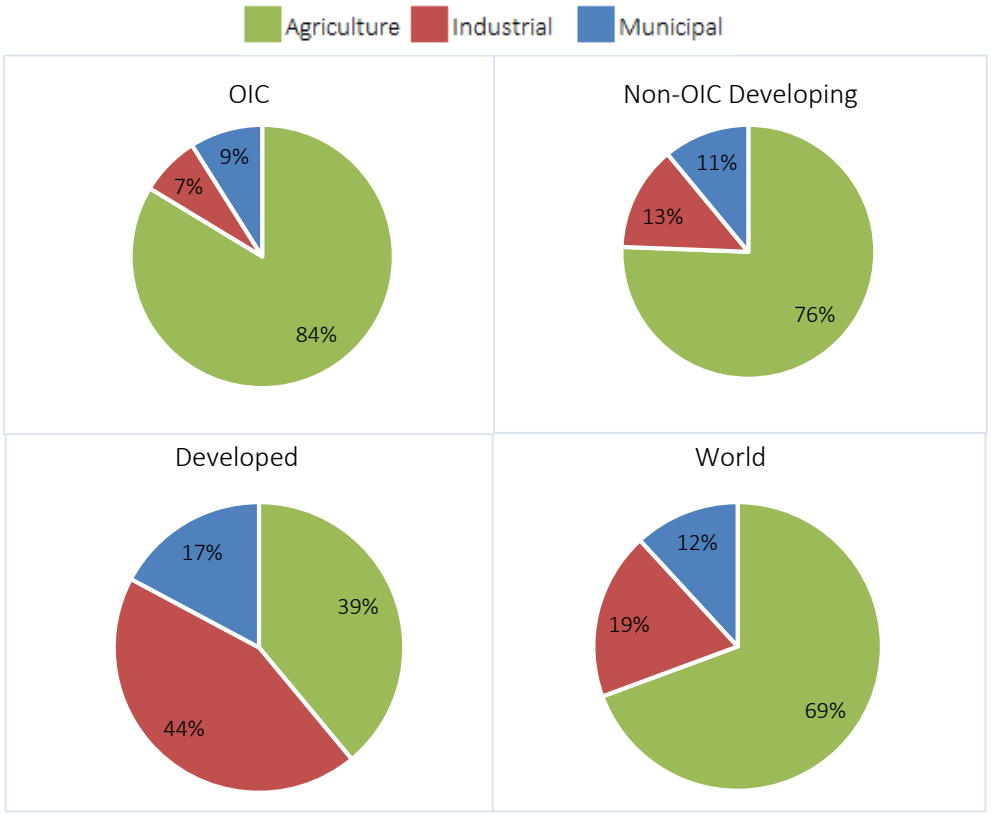
Source: *Adopted from FAO, Water at a glance: The relationship between water, agriculture, food security and poverty*
**Total exceed 100% because multiple causes are cited for many emergencies*

3.2 Competing Uses for Water

As OIC countries undergo urbanizing, more demand for water will come from municipal and industrial use. Meeting the demand for water from municipal and industrial use is vital for OIC countries to achieve their development goals; however, it carries the threat of diverting water resources from agriculture with all the negative and dangerous implications it has for food security. Furthermore, many poor and malnourished people still live in rural areas in OIC countries and depend on agriculture for income, employment and food. The fast pace of urbanization resulting in the increased use of water for municipal and industrial use threatens to reduce their access to water thus damaging their livelihoods.

As Figure 3.3 shows, globally, agriculture is the biggest user of water accounting for 69% of all water withdrawals.

Figure 3.3: Water Withdrawal by Sector, 2003-2017

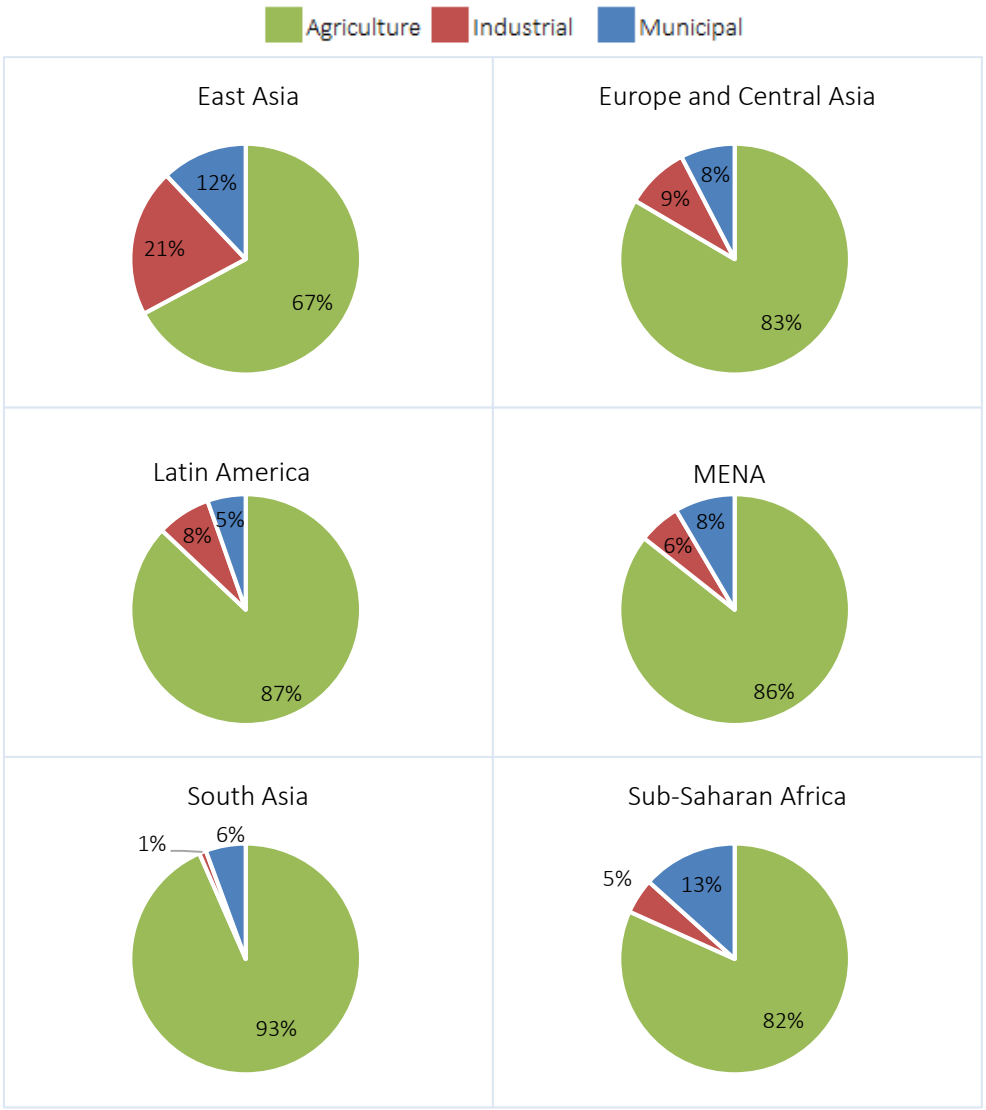


Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database.

Agricultural water use in OIC countries, which accounts for 84% of all water withdrawal, exceeds that observed in non-OIC developing countries (76%) and developed countries (39%). In OIC countries, municipal water use, which accounts for 9% of all water withdrawal, exceeds that of industrial water use, which accounts for 7% of all water withdrawal. This is in direct contrast with what is observed in non-OIC developing countries, developed countries and the world, where industrial water use surpasses that of municipal water use.

At the OIC regional level, the highest agricultural use of water is observed in OIC countries in South Asia, where it accounts for 93% of all water withdrawals (Figure 3.4). OIC countries in Latin America and OIC Countries in the Middle East and North Africa follow with agricultural water withdrawals accounting for 87% and 86% of all water withdrawals respectively. On the other hand, the lowest agricultural water use is observed in OIC countries in East Asia, followed by OIC countries in Sub-Saharan Africa and OIC countries in Europe and Central Asia, where it accounts for 67%, 82%, and 83% of all water withdrawal respectively.

Figure 3.4: Water Withdrawal by Sector in OIC Regions, 2003-2017



Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database.

Although at the OIC aggregate level, municipal water use exceeds that of industrial water use, at the OIC regional level the picture is quite different. In half of the OIC regions, agricultural water use exceeds that of municipal water use, namely in OIC countries in the Middle East and North Africa, South Asia, and Sub-Saharan Africa. In the other half of OIC regions, industrial water use exceeds that of municipal water use, specifically in OIC countries in East Asia, Europe and Central Asia, and Latin America.

The highest level of industrial water use as a percentage of total use is observed in OIC countries in East Asia (21%) followed by OIC countries in Europe and Central Asia (9%), and OIC countries in Latin America (8%). When it comes to municipal water use, the highest level of use as a percentage of total is observed in OIC countries in Sub-Saharan Africa (13%), followed by OIC countries in East Asia (12%) and OIC Countries in Europe and Central Asia and OIC countries in the Middle East and North Africa (both 8%).

3.3 Irrigation

The use of water in food production varies widely, reflecting environmental conditions (particularly water availability) as well as socio-economic conditions (including population density and institutional capacity). Whilst some countries are able to rely primarily on rain-fed irrigation for food production (e.g. Gabon, Gambia Sierra Leone, and Uganda), others need irrigation, with some developing sophisticated infrastructure such as: Algeria, Egypt, Libya, Syria, UAE (OIC Water Vision, 2012).

Irrigation can increase the yields of most crops significantly. The highest yields that can be obtained from irrigation are more than double the highest yields that can be obtained from rain-fed agriculture (FAO: Water at a Glance). Thus, irrigation holds the most potential for increasing food production and increasing food security. In spite of this fact, the area equipped for irrigation as a percentage of agricultural area in OIC countries is low when compared to non-OIC developing countries and the world average (see Table 3.1). The area equipped for irrigation as percentage of agricultural area in OIC countries stands at 5.3, compared to 7.3 and 6.1 for non-OIC developing countries and the world respectively. These figures indicate that OIC countries have a large room for improvement by increasing the percentage of areas that are irrigated.

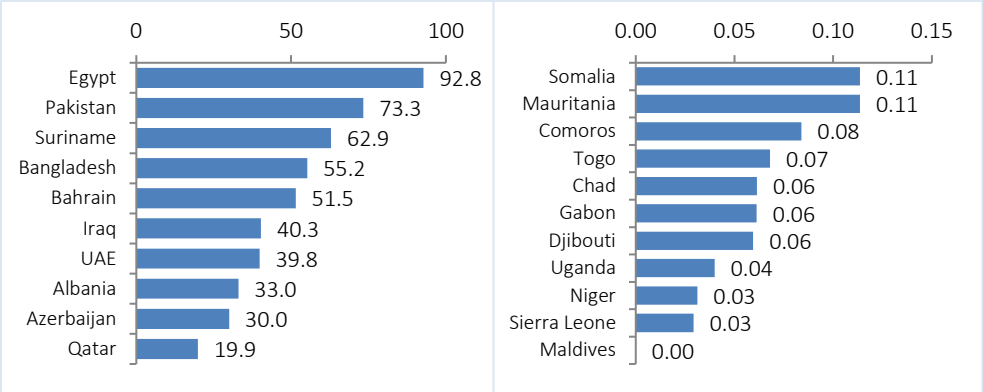
Table 3.1: Area Equipped for Irrigation, 2008-2017

Area equipped for irrigation as percentage of Agricultural Area	
OIC Countries	5.3
Other Developing Countries	7.3
World	6.1

Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database

At the individual country level, the percentage of agricultural area that is irrigated varies widely among OIC countries, ranging from near zero levels to 92.8% as can be seen in Figure 3.5, which shows the percentage of the irrigated area in the countries' total agricultural area. Only nine OIC countries have percentages exceeding 20%, whereas, the percentage in 13 OIC countries is lower than 0.2%.

Figure 3.5: OIC Countries with the Highest (left) and Lowest (right) Area Equipped for Irrigation as % of Agricultural Area, 2008-2017



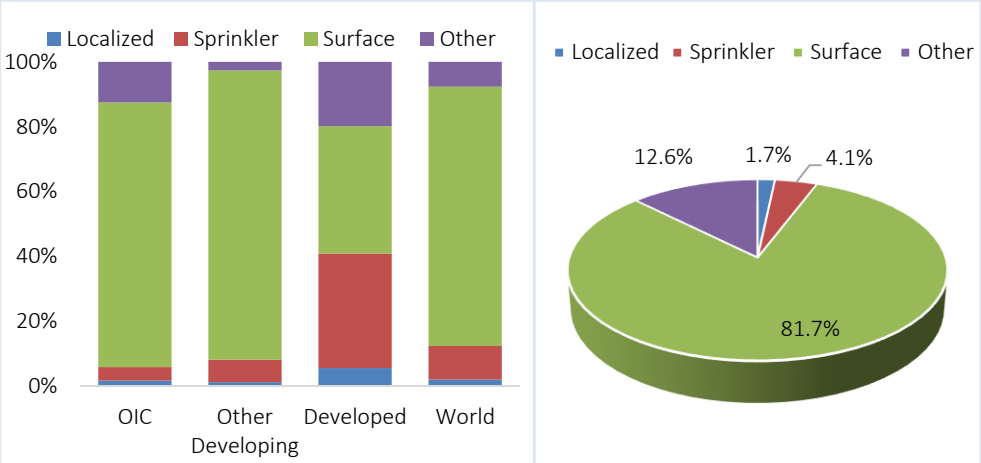
Source: FAO AQUASTAT Online Database.

The use of efficient irrigation systems and techniques has a crucial role in agricultural development and food production. In this regard, the available data on the irrigation techniques used in the OIC countries indicate that surface irrigation, which is the most traditional and most water-consuming technique, is by far the most widely used technique, practised in 81.7% of the total area equipped for irrigation, compared to other developing countries level of 89.3% (Figure 3.6, left). The ratio is more than 50% in 38 OIC countries. Consequently, huge amounts of the water diverted for irrigation in these countries are wasted at the farm level through either deep percolation or surface runoff.

In contrast, sprinkler irrigation is practised in 4.1% of the total area equipped for irrigation in the OIC countries (Figure 3.6, right). This technique which is more water-saving than surface irrigation, is practised in more than 25% of the irrigation area in only 4 OIC countries, namely, Côte d'Ivoire (75.4%), Saudi Arabia (59.4%), Benin (41.7%), and Lebanon (27.9%). Furthermore, the ratio is almost negligible (less than 0.1%) in 27 OIC countries.

On the other hand, localized irrigation technique, which is the most water-saving technique, is practised in only 1.7% of the total area equipped for irrigation in the OIC countries. Prevalence of this technique also varies across countries within the OIC region. United Arab Emirates and Jordan stand out with their remarkably high levels in use of this technique, reaching 86.3% and 81.2%, respectively. In addition to these two countries, the percentage is more than 10% in only 5 OIC countries, namely, Tunisia (16.9%), Kuwait (13.4%), Benin (12.4%), Bahrain (11.6%) and Qatar (10.9%). In contrast, the percentage is negligible in 34 OIC countries (less than 0.1%).

Figure 3.6: Irrigation Techniques as percentage of total area equipped for irrigation in the World (left) and in the OIC countries (right), 2008-2017



Source: SESRIC Staff Calculations based on FAO AQUASTAT Online Database

CHAPTER FOUR

Access to Water and Sanitation Services

According to the OIC Water Vision; adequate access to clean water and sanitation services is a central element of water security, and their importance to human health and productivity cannot be overstated. Within the OIC member states, water supply and sanitation service coverage ranges from very low to very high, with some nations providing universal access for all regions, while in other nations coverage is poor, and adequate household services limited to well-established urban areas. These differences largely reflect the variations in socio-economic conditions across the OIC (OIC Water Vision, 2012).

The OIC Water Vision identifies access to water and sanitation services as one of the major challenges that is still facing many OIC countries. This should not come as a surprise as access to water and sanitation services has a wide range of impacts ranging from health to the economy. Therefore, this chapter is devoted to the issues of access to water and sanitation services and their key impacts on sustainable development in OIC countries.

4.1 Water and Sanitation Services and Development

Our prophet Muhammad *"peace be upon him"* declares that: Muslims are partners in three things: water, pastures and fire[1]. By this, our prophet *"be peace upon him"* institutionalized a principle which is; all people should have access to water, access to water is a natural right to people and this access should not be denied.

Access to water is a basic human need. People need water to drink, cook, and for personnel hygiene. In addition, people need sanitation services that prevent contamination, diseases and that do not compromise dignity. So, it should come naturally, that access to water and sanitation services is recognized as a human right and has long been a central aim of international development policies and targets (UNGA, 2010). For example; the Millennium Development Goals "MDGs" sought to "halve the proportion of the population without access to safe drinking water and basic sanitation" between 1990 and 2015; while the Sustainable Development Goals (SDGs) calls to provide access to all.

Globally the MDG target on ensuring improved drinking water sources has been achieved; where by the year 2015, 90.7% of the world had access to improved drinking water sources. In 2015, 83.7% of OIC member country populations have access to improved water, compared to average of 91.3% in non-OIC developing countries and close to 100% in developed countries. Among the OIC member countries, a total of 25 countries have met the MDG 7.C.1 target of halving the proportion of people without access to sustainable improved water drinking sources.

As for the target of halving of the proportion of world population lacking access to improved sanitation facilities by 2015, it has been missed by almost 700 million people with only 67.4% of the world population having access to improved sanitation facilities.

[1] يقول الرسول صلى الله عليه وسلم :المسلمون شركاء في ثلاث: الماء والكلأ والنار. رواه الإمام أحمد وغيره

The percentage of OIC population using improved sanitation went up from 43% in 1990 to 61.7% in 2015, compared to 62.4% in non-OIC developing countries close to 100% in developed countries. Out of the OIC member countries, 16 countries have met the target, while the remaining did not achieve the target.

Moving from the MDGs to the SDGs, it is observed that the SDGs are more ambitious in terms of targets and in terms of scope. SDG 6.1 and SDG 6.2 call for access to all. They also go beyond providing access to improved water resources and sanitation facilities to achieving safely managed drinking water and sanitation services. The following sections provide a benchmark for OIC countries against SDG 6.1 and SDG 6.2.

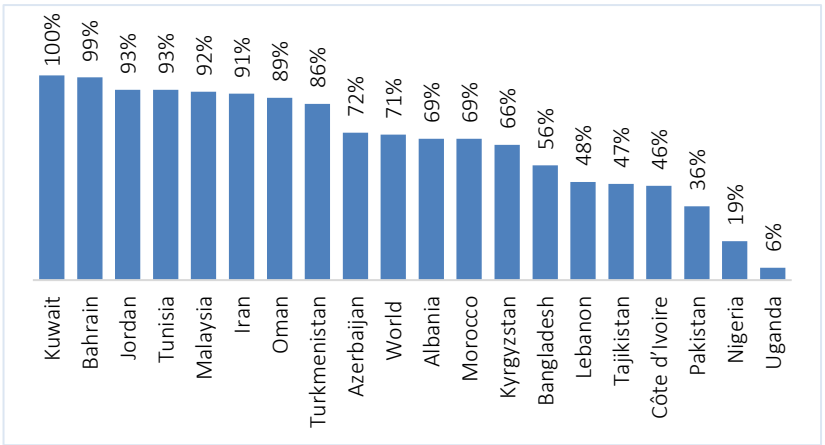
4.2 Safely Managed Drinking Water

Improved drinking water sources are those which by nature of their design and construction have the potential to deliver safe water. In order to meet the criteria for a safely managed drinking water service (SDG 6.1), people must use an improved source meeting three criteria:

- It should be accessible on premises,
- Water should be available when needed, and
- The water supplied should be free from contamination.

Data on safely managed drinking water is available for 96 countries of which 19 are OIC countries. 71% of the global population used a safely managed drinking water while in OIC countries the percentage ranged from a high of 100% in Kuwait to a low of 6% in Uganda (Figure 4.1).

Figure 4.1: Percentage of People Using Safely Managed Drinking Water.

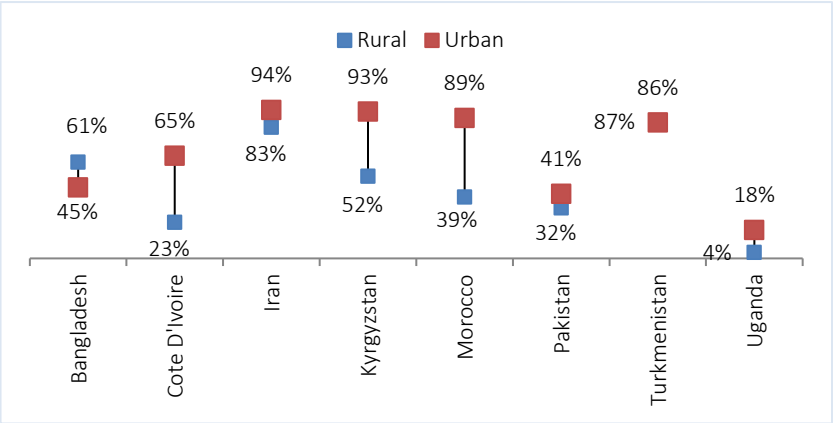


Source: WHO Data Repository.

In eight OIC countries, data is available on the breakdown of access to safely managed drinking water according to urban and rural settings (Figure 4.2). The figure reveals that significant disparities exist between rural and urban access to safely managed drinking water in OIC

member countries; suggesting inconsistent results in adopted water infrastructure development strategies.

Figure 4.2: Disparities in Rural and Urban Access to Safely Managed Drinking Water, 2015



Source: WHO Data Repository

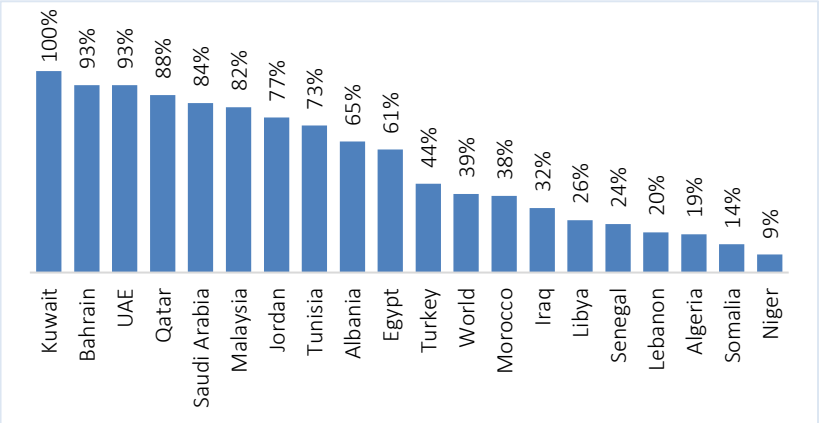
4.3 Safely Managed Sanitation Services

Improved sanitation facilities are those designed to hygienically separate excreta from human contact. There are three main ways to meet the criteria for having a safely managed sanitation service (SDG 6.2). People should use improved sanitation facilities that are not shared with other households, and the excreta produced should either be:

- Treated and disposed of in situ,
- Stored temporarily and then emptied, transported and treated off-site, or
- Transported through a sewer with wastewater and then treated off-site.

Data for safely managed sanitation services are available for 84 countries of which 19 are OIC Countries. 39% of the global population used safely managed sanitation services while the percentage in OIC countries ranged from a high of 100% in Kuwait to a low of 9% in Niger (Figure 4.3).

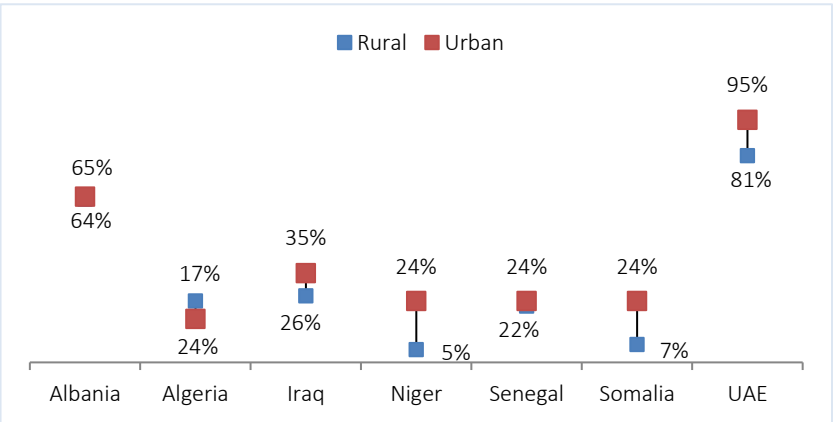
Figure 4.3: Percentage of People Using Safely Managed Sanitation



Source: WHO Data Repository.

In seven OIC countries, data is available on the breakdown of access to safely managed sanitation services according to urban and rural settings (Figure 4.4). The figure reveals that significant disparities exist between rural and urban access to safely managed drinking water in OIC member countries; suggesting inconsistent results in adopted sanitation services development strategies.

Figure 4.4: Disparities in Rural and Urban Access to Safely Managed Sanitation Services, 2015



Source: WHO Data Repository

PART II: TRANSFORMING RISK INTO DIALOGUE AND COOPERATION

CHAPTER FIVE

Water Security and Peace in the OIC

Humanity is investing huge amounts of resources and knowledge to discover water in some other parts of the universe, while neglecting to effectively address the challenges related to fresh water shortages felt across the world. With the expanding of world population, global water availability has been reduced from 40,000 m^3 per person in 1800 to 6,840 m^3 per person in 1995, and it is expected to decline further to 4,692 m^3 per person by 2025 (Gleditsch et al., 2006: 363).

Water scarcity is a matter of concern for many nations; particularly some of the OIC Member States as Chapter 2 has shown. At present, around 1 billion people in the world experience some form of water scarcity on a daily basis. Further, it is estimated that the lack of fresh water will increasingly become a devastating threat to humanity in the 21st century, and that by 2050 at least one in four people will live in a country where the lack of fresh water will be chronic (Guterres, 2018).

The United Nations (UN) started paying attention to water resources in 1972. The UN General Assembly (UNGA) proclaimed the period from 1981 to 1990 as "the International Drinking Water Supply and Sanitation Decade." However, a severe water crisis and protection of the quality and supply of fresh water resources was first brought to the attention of the international community at the UN Conference on Environment and Development, held in 1992 in Rio de Janiero, which came to be known as the Rio Earth Summit (Agenda 21, Chapter 18).

In response to the Rio Summit, with the intention of focusing attention on the importance of water, the UN General Assembly designated the 22nd of March of each year in 1993 as the World Water Day. A number of other actions in the water resources field were thereafter taken, including the proclamation of the International Year of Fresh Water in 2003, and the declaration of the period 2005-2015 as the International Decade of Action: Water for Life. Following all of these initiatives, international water cooperation among the UN Member States became an imperative. The importance of this is recognized by both, the UN Millennium Development Goals and the 2030 Agenda for Sustainable Development.

Until recently, international discourse on water was shaped around recognition of it as a human right and developmental issue. However, this approach has been enriched on 22 November 2016, when for the first time in the UN history, at the initiative of Senegal, the UN Security Council convened an Open Session on Water, Peace, and Security. This meeting represented a turning point in the discourse on water, adding to it the dimension of peace and security, with the call to transform water issue from a potential source of crisis into an instrument of peace and cooperation (UNSC, 2016). It is worth mentioning that the 34th Annual Plenary of InterAction Council - a body of former Heads of States and Governments - recommended that water security issue be multilaterally addressed and more centrally placed on the international agenda (InterAction, 2017). Furthermore, the High-Level Panel on Water,[2]

[2] From the OIC region, Prime Minister of Bangladesh, H.E. Mrs. Sheikh Hasina, former Prime Minister and Minister of Defense of Jordan, H.E. Dr. Hani Al-Mulki, President of Senegal, H.E. Mr. Macky Sall and

convened in January 2016 by the United Nations Secretary-General and the World Bank Group President, released its recommendations in March 2018 that promotes water security and the global and cooperative development and management of water resources (HLPW, 2018).

On 22 March 2018, the UNGA launched the International Decade for Action: Water for Sustainable Development 2018-2028, aimed at ensuring water security and advancing cooperation and partnership at all levels. This came in response to the water goals set in the 2030 Agenda for Sustainable Development, as well as in other recent milestone agreements, such as the Sendai Framework for Disaster Risk Reduction 2015-2030, and the 2015 Paris Agreement.

5.1 Some Observations on Water Security in OIC Countries

Achieving water security is one of the major challenges facing many OIC countries. The World Economic Forum reported that the global water crisis is the biggest danger facing the world over the next decade (WEF, 2015: 44). It is projected that in 2030, global demand for fresh water will increase and outstrip supply of fresh water by 40% (ICA, 2012: 1). Consequently, it becomes even more important to ensure water security.

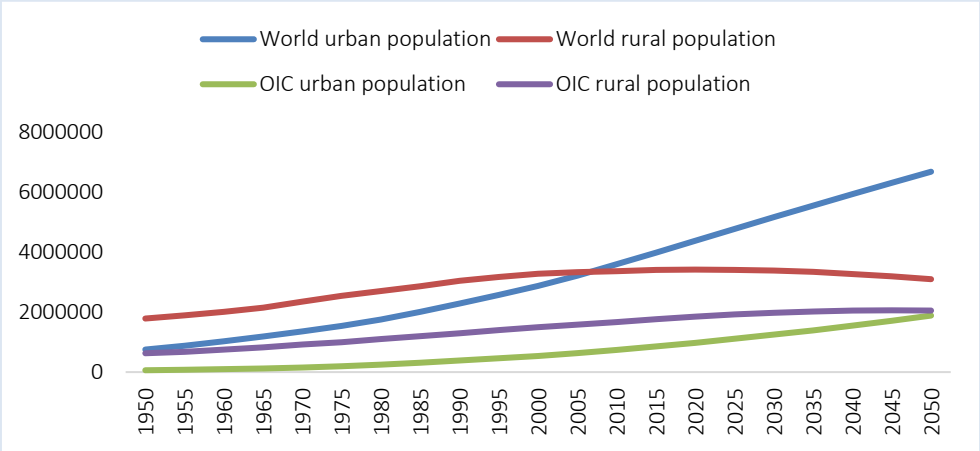
According to UN-Water, water security is the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability (Lougheed, 2013: 1).

It is obvious from the definition that, on the demand side, population growth and eventual improvements in living standards will be among the biggest drivers of water scarcity. The OIC region is currently home to around 24% of the world's population, and it is expected to be near 30% in 2050 (Figure 5.1).

As it is shown in Figure 5.1, the expected increase in OIC population will be closely associated with increases in the urban population. Of course, differences in urbanization rates among the OIC Member States are significant. For instance, Qatar and Kuwait are among the world's 20 most urbanised countries, while Chad, Afghanistan, Tajikistan, Comoros, Guyana and Burkina Faso are in the list of world's 20 least urbanized. Still, as the OIC urban population grows rapidly, this will put unprecedented stress on fresh water resources and already-overburdened delivery systems. Unfortunately, when water supply fails, a civilian population has no option but to migrate. It is projected that water scarcity may displace up to 700 million people in the world by 2030 (HLPW, 2018: 11).

President of Tajikistan, H.E. Mr. Emomali Rahmon participated as the Members of the High Level Panel on Water.

Figure 5.1: Global Distribution of Urban and Rural Population, 1950-2050 (thousands)



Source: UN, World Urbanization Prospects: The 2018 Revision, United Nations Department of Economic and Social Affairs, Population Division.

A growing population requires water not only to drink, but also to meet its increased food, industry and energy production needs. In this regard, population growth and water availability will inevitably affect the sustainability of agriculture - the biggest water consumer - and industry. This in turn will affect countries' ability to produce the products and services necessary for sustaining current standards of living. Even now, company leaders rank water crisis as one of the top risks to global prosperity, while some of them have begun to search for solutions (McDonald, R.I. and Shemie D., 2014).

As it is well known, energy sector is at the core of economic and social activity in all countries. Energy costs affect not only industries but also the overall cost of living. However, most power generation consumes water, whether in hydroelectric power generation, thermoelectric power plant cooling, or in energy-resource extraction, refining, and processing. Therefore, as global energy consumption continues to increase, as much as 50% by 2030, so will the demand for water supplies and resources to support this growth (Hightower, 2011: 2). This means that water scarcity will directly affect electricity supplies, particularly in the countries where the biggest percentage of electricity is generated by water-dependent hydropower. In this regard, some OIC Member States such as Albania, Tajikistan, Kyrgyzstan and Mozambique are very vulnerable to the changes in water supplies, because in 2014, percentage of electricity production from hydroelectric sources in their total electricity production amounted to 100%, 97%, 91% and 91% respectively.

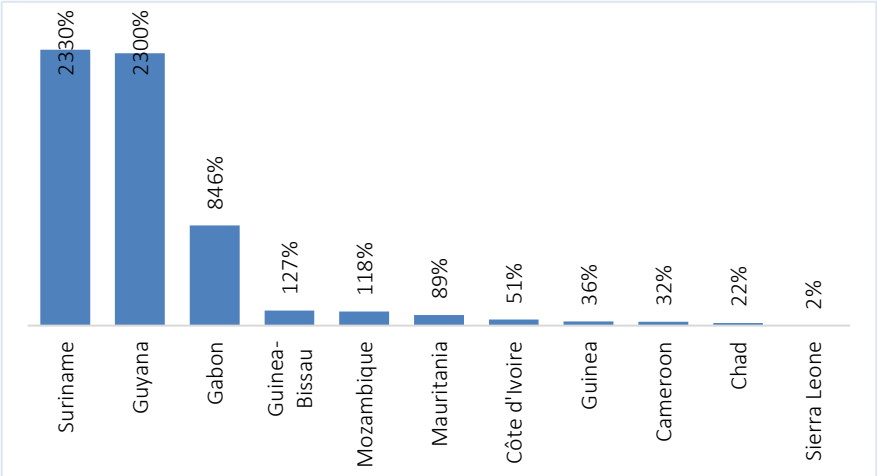
Hydropower is an important source of low-carbon electricity for many OIC nations, and traditional solution to drought periods is building bigger dams and deeper wells. It is projected that in the next three decades, global hydropower capacity will be doubled (Opperman, 2015: 7). However, a doubling of hydropower capacity means affecting 300,000 km of rivers worldwide through disrupting river connectivity and altering water flows. This will put under

risk many other values that rivers provide, including fisheries and agriculture that feed hundreds of millions of people in some of the river basins, as well as ecological values. A research done by the Nature Conservancy demonstrates that the performance of a dam is connected to all the other dams on that river and to the functioning of the river itself. To achieve full economic potential of dams and avoid its negative social and environmental consequences, the Nature Conservancy proposes a system-scale planning method. This method promotes more balanced outcomes from hydropower development, through planning and managing hydropower projects not at the community-scale, but at the system scale - in the context of the entire river basin (For more details look at Opperman, 2015).

It is clear from the research of the Nature Conservancy that water security and ecological integrity are directly related. Indeed, investing in natural infrastructure –healthy forests, wetlands and river ecosystems – from which water supply is sourced can play a role in cleaning and filtering water as it comes to our communities, thus ensuring cost-effective and long-term solutions to water security. For that reason, integrating nature-based solutions in water infrastructure planning and spending is essential (Abell, et al. 2017). The 2018 edition of the UN World Water Development Report points out to different nature-based solutions for improvement of water management (WWAP/UN-Water, 2018).

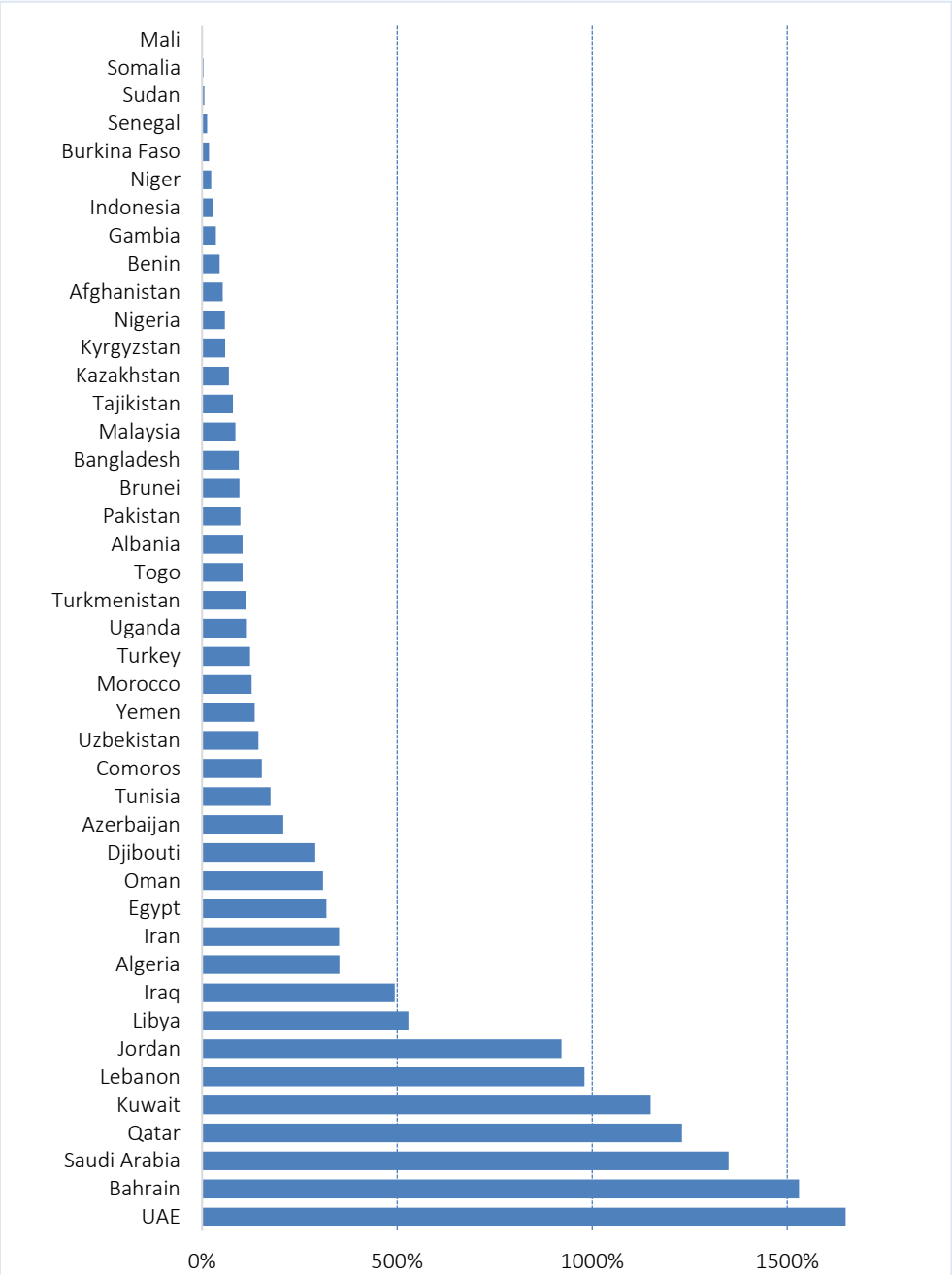
Unfortunately, ecological footprints of many OIC Member States exceed their biocapacities, meaning that they run on an ecological deficit. In other words, as Figure 5.2 and Figure 5.3 show, the majority of OIC countries are annually consuming more of resources - such as water, land and forests, than nature can regenerate within one year.

Figure 5.2: OIC Member States with Biocapacity Reserve (percentage that biocapacity exceeds ecological footprint, 2014)



Source: Global Footprint Network, National Footprint Accounts, 2018 Edition.
Notes: Footprint and biocapacity accounting are usefull in finding answer on how much do one nation demand from biologically productive surfaces such as land and water area (Ecological Footprint), compared to how much the countrie's productive surface can regenerate on those surfaces (biocapacity)

Figure 5.3: OIC Member States with Biocapacity Deficit
(percentage that Ecological Footprint exceeds biocapacity, 2014)



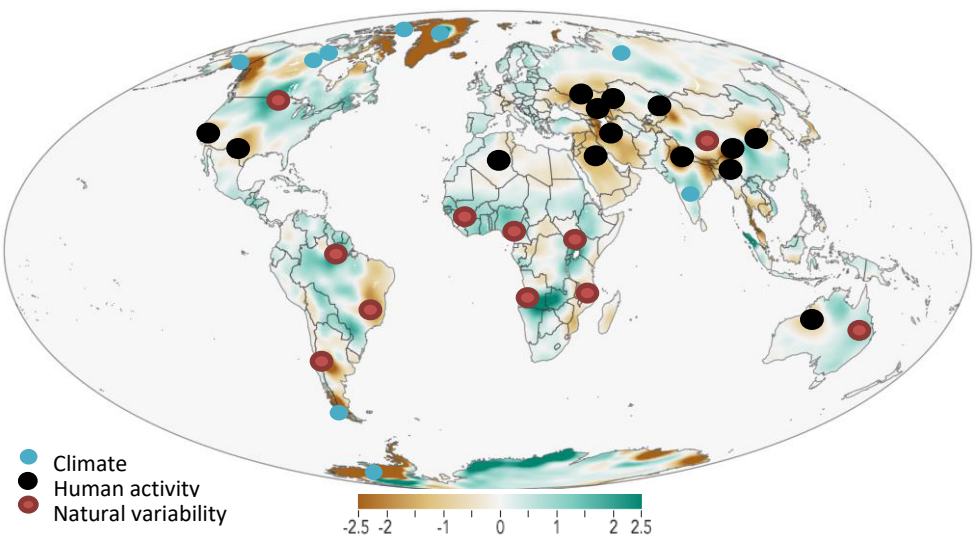
Source: Global Footprint Network, National Footprint Accounts, 2018 Edition.
Notes: Footprint and biocapacity accounting are usefull in finding answer on how much do one nation demand from biologically productive surfaces such as land and water area (Ecological Footprint), compared to how much the countrie's productive surface can regenerate on those surfaces (biocapacity)

In 2014, only Suriname, Guyana, Gabon, Guinea-Bissau, Mozambique, Mauritania, Côte d'Ivoire, Guinea, Cameroon, Chad and Sierra Leone had a biocapacity reserve, while the remaining OIC Member countries had a biocapacity deficit. In the United Arab Emirates for example, demand on the countries' ecosystems exceeded what nature is able to regenerate by 1650% or in Bahrain, Saudi Arabia, Qatar and Kuwait by 1530%, 1350%, 1230% and 1150% respectively. Physical characteristics and geographical position of these countries may partly explain the existence of such a big biocapacity deficit. Still, it is obvious from these figures that OIC countries on average are consuming their resources faster than the planet can replenish them.

Debt to the planet arising from biocapacity deficit is being paid through climate change, which is increasing the frequency of severe droughts and floods, affecting global rainfall patterns and stability of the global hydrological cycle/natural variability of fresh water, thus rapidly eroding the amount of fresh water available (SFG, 2017: iii).

Figure 5.4 illustrates findings from the NASA Gravity Recovery and Climate Experiment Satellite Mission, showing the 34 regions in the world with the most dramatic water shortage changes, registered in the period from 2002 to 2016. Reason for water shortages in 9 out of 34 identified regions is climate change, while water shortages in 14 regions are attributed directly to human activity. Scientists believe that besides global warning, the human factor is also affecting natural variability of fresh water globally.

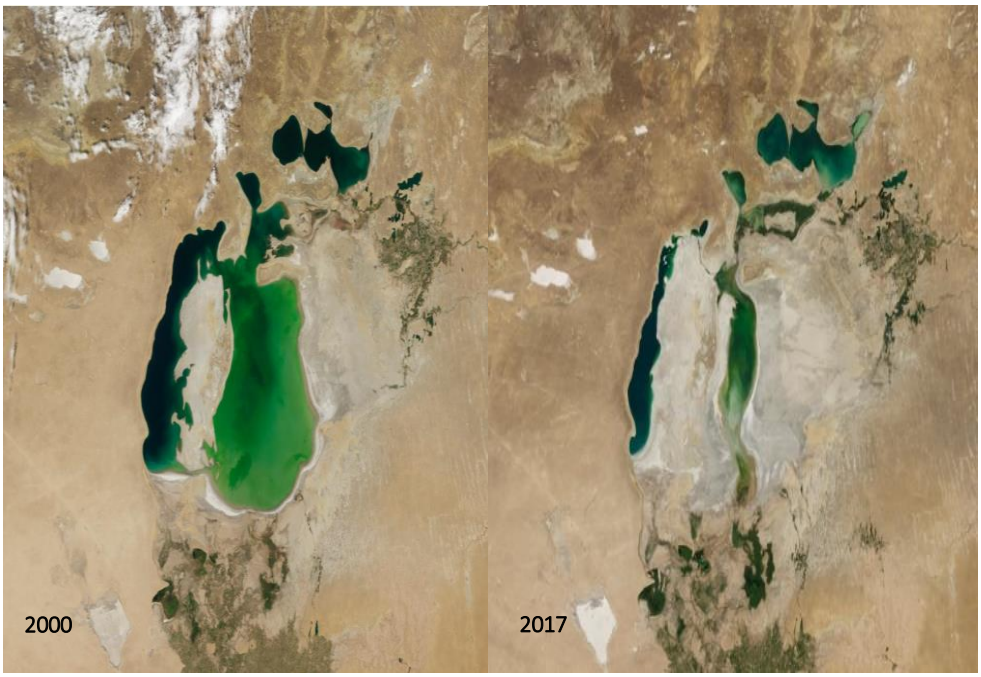
Figure 5.4: Annual Change in Water Storage (2002 - 2016, cm)



Source: Adapted from NASA Gravity Recovery and Climate Experiment Sattelite Mission data.

Downward trends in fresh water seen in Saudi Arabia reflect agricultural pressures rising from explosive growth of irrigated farmland. Data from NASA point out that in average, Saudi Arabia lost 6.1 gigatons per year of stored groundwater in the period from 2002 to 2016.[3] Iran, Iraq, and Syria are part of the geography which losses 32.1 gigatons of fresh water per year. Another important region in the OIC with dramatic decline of fresh water is the Caspian Sea, where overuse of water resources is causing a loss of 23.7 gigatons of fresh water annually (for more details see at Rodell M. Et al, 2018). This depletion is a reminder of the well-known fate of the disappearing Aral Sea in the same region (Figure 5.5). Without better management of water resources, the situation in related countries and areas is likely to worsen in the future.

Figure 5.5: Shrinking Aral Sea, 2000-2017



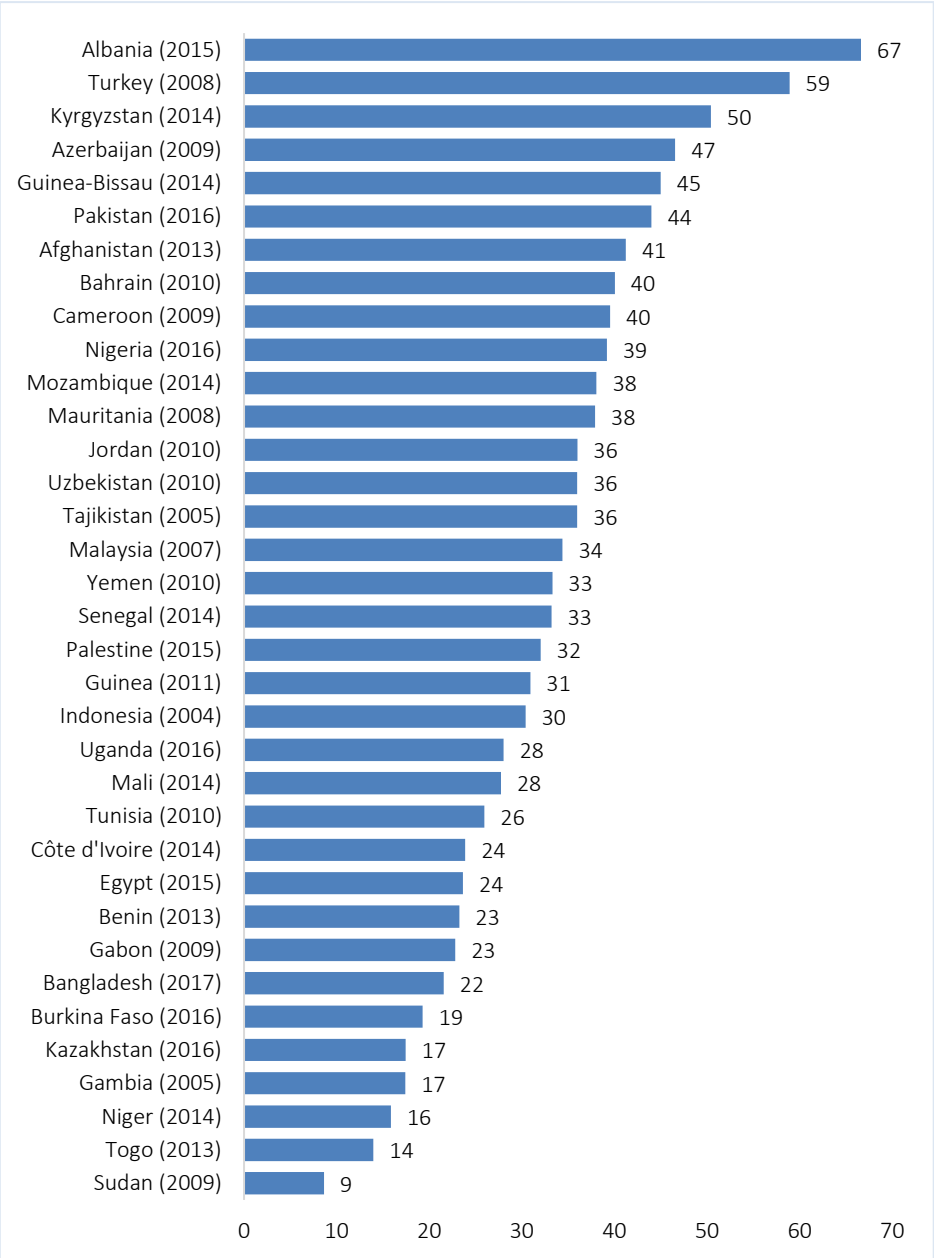
Source: NASA

Investments and strong actions by governments are also required to maintain and repair outdated water infrastructure. This is necessary to avoid water loss, which is considered an important element affecting water supply. Unfortunately, as can be seen from Figure 5.6, in many OIC Member States there is a huge difference between the amount of water put into

[3] More than 90% of liquid fresh water is found underground. Surface water in rivers and lakes (0.26%) and atmospheric water (0.04%) represent only a small amount of total fresh water (Global High-Level Panel on Water and Peace, 2017: 11).

the distribution system and the amount of water billed to consumers. These water losses are called “non-revenue water”.

Figure 5.6: Non-Revenue Water Losses in the OIC Member States (%)



Source: International Benchmarking Network (IBNET) database.
Notes: Non-revenue water refer to difference between the amount of water put into the distribution system and the amount of water billed to consumers.

Levels of non-revenue water reflect volumes of water being lost through leaks, not being invoiced to customers, or both. The average figure for non-revenue water levels in developing countries covered by the World Bank database on water utility performance IBNET is around 35 (Kingdom et al., 2006: 2). However, many OIC Member States are above this average, particularly in Albania, Turkey and Kyrgyzstan, where annual water loss is above 50%. This is an enormous waste of clean water, and a waste of the resources that have been used to extract the water, treat it and distribute it. In addition, it is lost revenue that affects the financial viability of water utilities.

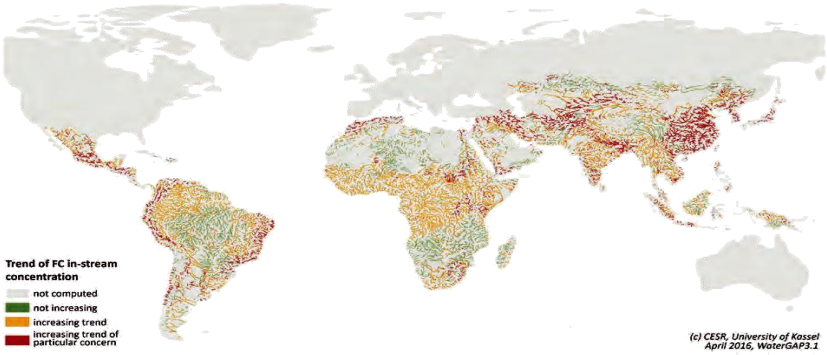
In developing countries, about 45 million cubic meters of water are lost daily through water leakage in the distribution networks, and 30 million cubic meters are delivered every day to customers, but are not invoiced for different reasons, such as pilferage, employees' corruption, poor metering and smuggling of water (Kingdom et al., 2006: v). A high percentage of non-revenue water normally indicates a weak governance of water utilities, poor accountability, and the lack of necessary technical and managerial skills.

Another factor having impact on water supply is pollution, which is placing hundreds of millions of people at risk of life-threatening diseases. About 3.4 million people die each year from these diseases. Further, it is estimated that up to 25 million people in Latin America, up to 164 million in Africa and up to 134 million in Asia are under risk of infection, due to high concentrations of faecal coliform bacteria in rivers. These are some of the findings of UN Environment Program (UNEP), which warned of the worrying rise in the pollution of surface waters[4] in Asia, Africa and Latin America (UNEP, 2016: 17-22).

Two important parameters for measuring pollution in surface waters are faecal coliform bacteria - indicating a pathogen pollution, and biochemical oxygen demand (BOD) - reflecting organic pollution. High values of these parameters indicate health risk for individuals exposed to polluted water. Significance of faecal coliform bacteria is in the fact that indicates presence of sewage contamination of a waterway and the possible presence of other pathogenic organisms. As could be seen from Figure 5.7, severe pollution appears to be greatest in Asia, where about a third to one-half of river stretches is contaminated. In Africa, around 10 to 25% of river stretches are subject to this pathogen pollution (UNEP, 2016: xxix). It should be noted that concentrations of faecal coliform bacteria have increased between 1990 and 2010 in almost two-thirds of all rivers in Asia, Africa and Latin America. Bangladesh, Iran, Iraq, Kazakhstan, Morocco and Sudan are among OIC Member States where some river stretches fall into the severe pollution category of faecal coliform bacteria.

[4] Surface waters are those that flow in streams, rivers, natural lakes, wetlands and reservoirs.

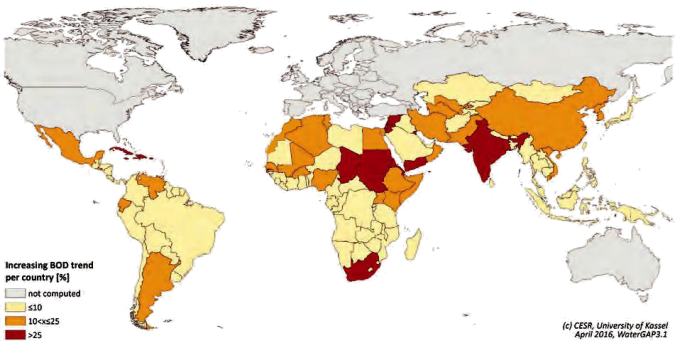
Figure 5.7: Trend in Faecal Coliform Bacteria Levels in Rivers between 1990–1992 and 2008–2010



Source: UNEP, A Snapshot of the World's Water Quality: Towards a Global Assessment, Nairobi: United Nations Environment Programme, 2016, p. 20.
Notes: River stretches marked with orange or red have increasing concentrations between 1990-1992 and 2008-2010. River stretches marked red have an increasing trend of particular concern, which means that they fall into severe pollution category.

A different parameter for analysing water pollution is Biochemical Oxygen Demand (BOD), which measures the amount of dissolved oxygen, used by aerobic microorganisms when organic matter decomposes in water. BOD is widely used to determine the impact of sewage releases into rivers. Severe organic pollution (high BOD levels) can lead to complete deoxygenation (anoxia), in which very few organisms can survive. Figure 5.8 illustrates that between 1990 and 2010 BOD value increased in all rivers in Asia, Africa and Latin America. The pollution levels increased into the severe pollution category in about 10-25% of river stretches in Algeria, Burkina Faso, Djibouti, Egypt, Gambia, Iran, Mali, Morocco, Nigeria, Pakistan, Senegal, Somalia, Tunisia, Turkmenistan, Uganda and Uzbekistan. Bangladesh, Chad, Jordan,

Figure 5.8: Percentage of River Stretches with Increasing Trend of Biochemical Oxygen Demand of Particular Concern



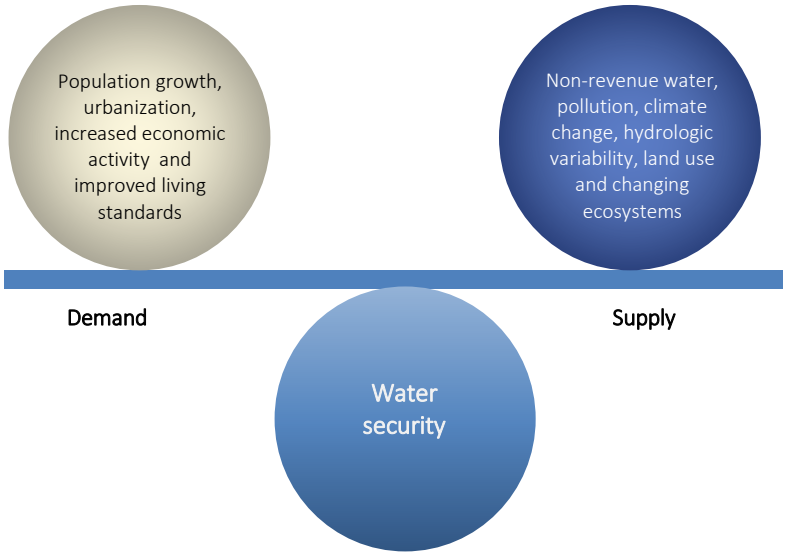
Source: UNEP, A Snapshot of the World's Water Quality: Towards a Global Assessment, Nairobi: United Nations Environment Programme, 2016, p. 27.
Notes: Meaning of "trend of biochemical oxygen demand of particular concern" is that in identified river stretches the pollution level increased into the severe pollution category in 2008–2010, or that they were already in the severe pollution category in 1990–1992 and further increased in concentration by 2008–2010.

Kuwait, Lebanon, Palestine, Sudan, Syria and Yemen are even worse affected; where in more than 25% of river stretches increasing trend of severe pollution is observed.

Population growth, industrial development, the expansion of irrigated agriculture and increase in the amount of untreated sewage discharged into rivers and lakes are the main reasons behind the troubling rise in surface water pollution in OIC Member States. Vital sources of food, human health and national economies are at risk if countries fail to stop the pollution. The solution is not only to build more sewers but to treat wastewater, and enable usage by all relevant sectors.

Achieving a sustainable balance between supply and demand is key to achieving water security, i.e. enough water of the right quality for the purpose for which is needed. Figure 5.9 is prepared based on the above discussions. Population growth, urbanization, increased economic activity and improved living standards will continue with pressures on water demand, while non-revenue water, pollution, climate change, hydrologic variability, land use and changing ecosystems will determine the future of water supply.

Figure 5.9: Achieving Water Security



Source: SESRIC staff design.

Water security is possible only through balancing demand and supply sides. For this reason, it would be understandable to argue that water security is a complex issue, which calls for a paradigm shift in the way we think about water. It requests changes in policy and in the behaviour of specific sectors, market actors and institutions.

If water-stressed OIC Member States don't act soon, particularly countries where companies, farms and residents are already vulnerable to the slightest change in fresh water supply,

growing population and competing sectoral demands for water then the result will be increased water shortages, health crises, and most probably disputes over water and migration of people in search for better opportunities.

5.2 Risk of Water Related Conflicts in the OIC

As it has been frequently argued in different reports, competition over water is expected to intensify within societies where fresh water is not equally distributed. Citizens, especially the poor people with limited access to drinking water may create social unrest difficult to control. Domestic-level water conflict may also be a result of conflicting interests of individuals, sectors, firms as well as governmental politics around water (Bohmelt et al., 2014: 338). For example, the relative wealth and the political weight of particular areas within countries may determine the distribution of irrigation and water-saving technologies. The ineffective and selective water servicing may be caused by the lack of a well-functioning bureaucracy around water or short-term electoral expectations. In such cases, when conflict over water erupts, it is often due to poor governance, mismanagement and unfair distribution, which lead to systematic differences in water access for the population (Raleigh C., 2018: 550-555).

On the other hand, distribution of fresh water around the world is uneven. Some countries and regions are far more fortunate than others. An additional problem arises when fresh water resources such as aquifers, lakes and rivers, are shared by two or more nations. In many cases, hydrological boundaries and administrative borders do not coincide. Three-quarters of UN Member States share rivers or lake basins with their neighbours. If access to these waters - both surface and groundwater is not managed well, the competition between states over them may trigger political disputes and instability in many parts of the world (Renaud and Wirkus, 2012: 38).

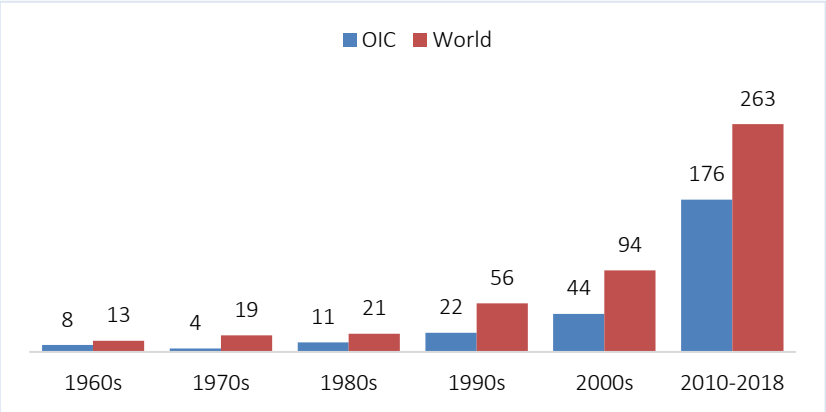
Actually, history witnesses that water tensions have led to more international water agreements than violent conflicts. Indeed, many case studies have reached to the conclusion that in situations of scarcity, cooperation – instead of conflict – is the dominant societal response in both domestic and international settings (Raleigh C., 2018: 550). Further, different studies have shown that water is seldom the single cause of armed conflict, and that it is more a contributing factor to violence in areas where territorial dispute, nationalism and ethnic rivalry exists. Still, as water shortages become more acute with rapid growing world population, international water disputes are expected to increase (ICA, 2012: 3).

In many conflicts, water may become a military and strategic tool or target, a weapon of war that affects access to clean water. Destruction of water facilities, attacks against power plants that provide water supplies and contamination of groundwater resources are among examples that different nation face in different parts of the world. For example, between 2013 and 2015, the terrorist organization DAESH launched around 20 attacks against water infrastructure in Syrian and Iraqi, while Assad's forces bombed water sources around Damascus to cut off water to 5.5 million people.

The water think tank the Pacific Institute has developed a unique chronology on fresh water conflicts in the world, from which it is more than visible that these conflicts are not just an issue for the future, but that conflicts over water (instances in which water and violence have gone together), have been increasing in number for decades.

Figure 5.10 illustrates a sharply increasing trend of conflicts over fresh water, particularly in the period from 1990 to 2018, which features the most acute rise in conflict cases. Conflicts over fresh water are strongly present in the OIC region, where during the observed period (1960-May 2018) 56% of world water conflicts are realized. During the period from 2010 to May 2018 fresh water in the OIC geography was behind more violence than ever (Figure 5.10 and 5.11), with increase to 67% of global water conflicts. However, from 1960 to 2018, many of water incidents are materialized at the sub-national level (72%) - including actions of terror-driven non-state actors, rather than as disputes among OIC nations (28%).

Figure 5.10: Number of Conflicts over Fresh Water Concerning the OIC



Source: Pacific Institute, The Water Conflict Chronology, https://www.worldwater.org/water-conflict

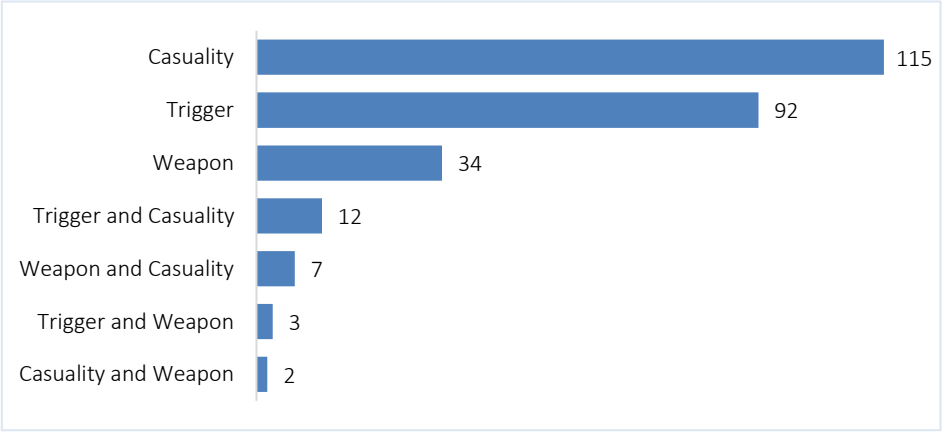
Actually in the previous decades, nation-vs-nation or state-vs-state kinds of conflicts were more dominant; however, particularly in the last decade, there have been more and more instances of violence related to water at subnational level, such as conflicts between ethnic groups, conflicts between pastoralists and farmers over access to water etc. Since diplomatic tools are not useful in resolving this kind of subnational conflicts, they are much harder to deal with.

Figure 5.11: Conflict Places over Fresh Water (2010 - May 2018)

Source: The Pacific Institute, The Water Conflict Chronology, https://www.worldwater.org/water-conflict
Notes: Majority of conflicts over fresh water occurred worldwide in the period from 2010 to May 2018 was concentrated in MENA region (108 cases), Sub-Saharan Africa (67 cases) and Southern Asia (38 cases).

Breakdown of types of conflict over fresh water concerning OIC Member States (Figure 5.12) illustrates that majority of them (115 cases) are in the "causality" category, where fresh water resources and systems were intentional targets or incidental casualties of violence. Unfortunately, most recently, especially in the Middle East, there is an increase in such attacks on water systems, particularly in Syria, Iraq and Yemen. In 92 cases, dispute over access and

Figure 5.12: Conflict Types over Fresh Water Concerning the OIC Member States (1960 - May 2018)



Source: Pacific Institute, The Water Conflict Chronology, https://www.worldwater.org/water-conflict
Casualty: Water resources or water systems as a casualty of conflict, where water resources, or water systems, are intentional or incidental casualties or targets of violence.
Trigger: Water as a trigger or root cause of conflict, where there is a dispute over the control of water or water systems or where economic or physical access to water, or scarcity of water, triggers violence.
Weapon: Water as a weapon of conflict, where water resources, or water systems themselves, are used as a tool or weapon in a violent conflict.

control of scarce fresh water sources have triggered violent conflicts. Number of instances where water is used as a weapon in a violent conflict is 34. A case in point is Somalia where in January 2017 at least 32 people died after drinking water from a poisoned well. Rest of the instances (24) in which water and violence have gone together had mixed characteristics.

5.3 Need for Transboundary Fresh Water Cooperation

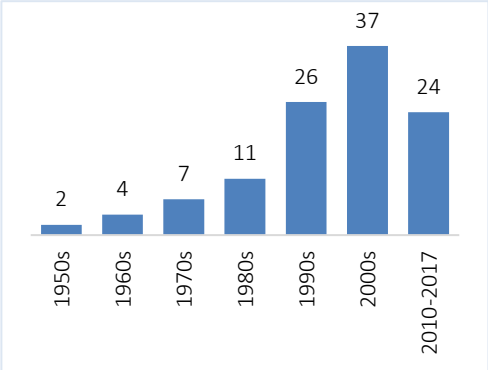
We are living in the world where "domestic" and "foreign" dimensions have been weakened and where global and regional issues increasingly affect citizens more directly, be it water security issues, environmental threats or financial and economic issues. Resolution of the issues, whose nature and dimension exceed the national area, requires transnational cross-border cooperation.

Water challenges in the OIC are undoubtedly serious but they are not the only one. Low levels of economic growth, high unemployment, inadequate rise in living standards, along with several unresolved bilateral issues and domestic political challenges continue to burden relations in the OIC. Furthermore, in the face of growing ideological extremism, increased organized crime activity, and pressures of migrations, it would be hard to expect stability in the OIC region, if selfish policies are opted related to transboundary fresh waters.

International water law has developed a number of rules and institutions that provide the basis of international water cooperation. It could be argued that international water law, basin-specific bilateral and multilateral agreements, as well as presence of useful diplomatic tools are among the reasons of a decrease in nation-to-nation conflicts over water.

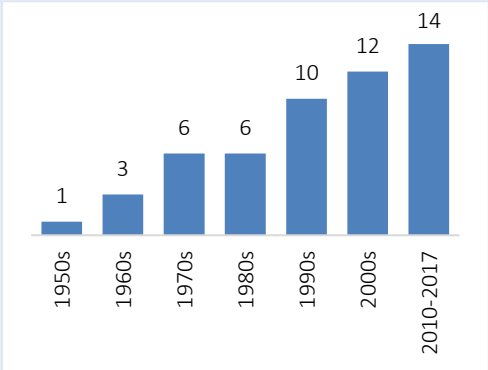
With respect to fresh water, the world has seen a drastic upsurge in the number of signed international agreements on fresh water after the Second World War. Information provided by the United Nations Food and Agriculture Organization's FAOLEX database documents that in last seven decades around 300 such agreements worldwide were signed, in which fresh water is a primary subject. Increase in these agreements is particularly evident for the period after 1970s. Here, it should be noted that Bahrain, Comoros, Kuwait, Maldives, Oman, Qatar, Saudi Arabia, United Arab Emirates and Yemen are the OIC Member States with no shared surface watercourses.

Figure 5.13: Number of International Water Agreements that Include the OIC Member States (1950-2017)



Source: FAOLEX database.
Notes: Figure is prepared based on international agreements whose primary subject is fresh water and which include at least one OIC Member State. Agreements related to sea are excluded.

Figure 5.14: Number of International Water Agreements Signed Among the OIC Member States (1950-2017)



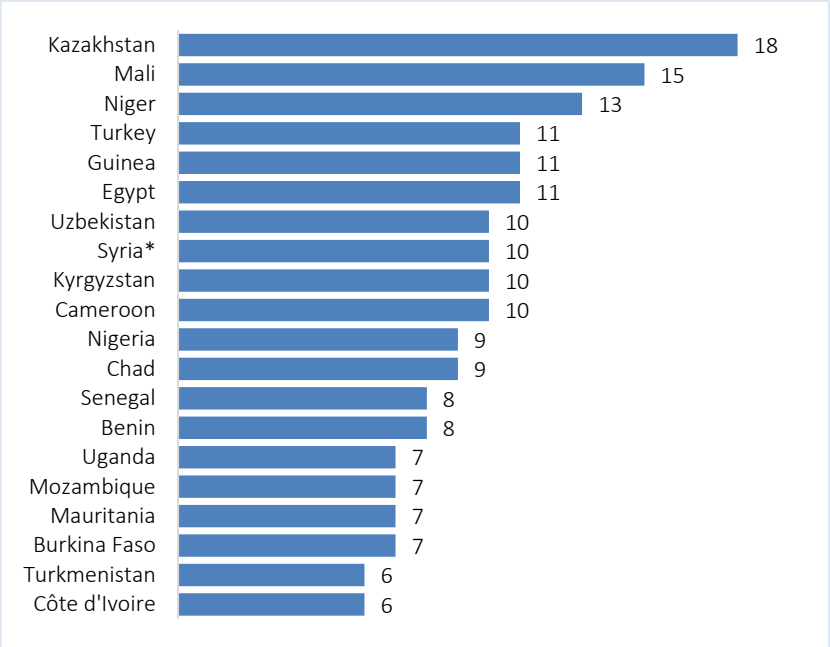
Source: FAOLEX database.
Notes: Figure is prepared based on international agreements whose primary subject is fresh water. Agreements related to sea are excluded.

Only two international agreements on fresh water that include at least one OIC Member State were signed in the decade of the 1950s, a number that increased by the end of the 2017 to 111 in total (Figure 5.13). Almost half of these agreements are signed only among the OIC Member States (Figure 5.14).

It is obvious that the OIC Member States, especially Kazakhstan, Mali, Niger, Turkey, Guinea and Egypt, made commendable efforts over time towards the peaceful management of transboundary water resources, with the signing of many international agreements on fresh water (Figure 5.15). However, to what extent does this water cooperation translate into institutional cooperation at the practical level? In reality, if transboundary water cooperation is to have an impact, it must be active, dynamic and politically driven.

The Water Cooperation Quotient, developed by the Strategic Foresight Group, makes an interesting case about the countries engaged in active, dynamic and politically driven water cooperation, as an underlying cause for not going to war. Through extensive analysis of 146 riparian countries and 286 shared watercourses, the Strategic Foresight Group has shown that active water cooperation exists only in 32% of shared watercourses, whereas in 64% of them at least minimum level of cooperation is present. In 49 watercourses, there is no cooperation at all. According to the Strategic Foresight Group, countries that are at risk of war are ones that do not engage in active water cooperation (SFG 2017).

Figure 5.15: Distribution of International Water Agreements by OIC Member States (1950-2017)



Source: FAOLEX database.
Notes: Figure is prepared based on international agreements whose primary subject is fresh water and which includes at least one OIC Member State. Agreements related to sea are not included.

The Water Cooperation Quotient Ranking, in this regard, serves as an early warning system for the countries to improve their cooperation on transboundary waters. The ranking is based upon analysis of the agreements between riparian states, shared institutional structures, access to and exchange of data on a regular basis, water resources management and ecosystem protection, and political commitment.

Countries that score 50 and above in Water Cooperation Quotient have no risk of war. If their score is between 23.33 and 50, countries are on the path of peace building. If a country has a score less than 23.33, it could be at a risk of war. Still, it does not mean that countries below 23.33 are surely at risk of war. For example, some countries may have low score because their efforts for transboundary water cooperation are relatively new, or they may be facing financial constraints and therefore not opting to pursue intense cooperation. Again, with a score less than 23.33, some countries may not face the risk of war, but they may be involved in extremely cold relationship that dissuades them from active water cooperation (SFG 2017: 2-3).

Below is a list of transboundary watercourses that include the OIC Member States, and their scores in the Water Cooperation Quotient 2017.

Table 5.1: Water Cooperation Quotient Ranking 2017

Transboundry Watercourse Cooperation Platforms	Ranking
The Organization for Development of the Senegal River - OMVS (Guinea, Mali, Mauritania, Senegal)	100
The Gambia River Basin Development Organization - OMVG (Gambia, Guinea, Guinea-Bissau, Senegal)	100
Niger Basin Authority - NBA (Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Guinea, Mali, Niger, Nigeria)	100
Tripartite Permanent Technical Committee - TPTC (Mozambique, South Africa, Swaziland)	83.33
Tripartite Permanent Technical Committee - TPTC and Komati Basin Water Authority - KOBWA (Mozambique, South Africa, Swaziland)	83.33
Amazon Cooperation Treaty Organization - ACTO (Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Venezuela)	73.33
Chu-Talas Commission (Kazakhstan-Kyrgyzstan)	68
International Fund for saving the Aral Sea - IFAS and Multiple permanent joint and regional bodies including Interstate Coordination Water Commission - ICWC (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) *Aral Sea	66.67
International Commission of the Congo-Oubangui-Sangha Basin - CICOS (Angola, Cameroon, Central African Republic, Democratic Republic of the Congo, Gabon, Republic of the Congo)	66.67
Volta Basin Authority - VBA (Benin, Burkina Faso, {Côte d'Ivoire}, Ghana, Mali, Togo)	66.67
Zambezi Watercourse Commission - ZAMCOM (Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zimbabwe)	66.67
India-Bangladesh Joint Rivers Commission - JRC (Bangladesh-India)	60
Israeli-Jordanian Joint Water Committee (Israel-Jordan) *Jordan River	56.67
Permanent Joint Technical Commission for the Nile Waters - PJTC (Egypt-Sudan) *Nile	56.67
Technical Working Group (Bulgaria-Turkey)	56
Kura-Araks* (Armenia-Iran)	53.33
Lake Chad Basin Commission - LCBC (Cameroon, Chad, Central African Republic, Libya, Niger, Nigeria)	53.33
Limpopo Watercourse Commission - LIMCOM (Botswana, Mozambique, South Africa, Zimbabwe)	53.33
Joint Technical Committee (Iraq-Turkey) *Tigris-Euphrates	53.33
Golok (Malaysia-Thailand)	52
India-Bangladesh Joint Rivers Commission - JRC (Bangladesh-India) *Ganges-Brahmaputra-Meghna	50
Nile Basin Initiative - NBI (Burundi, Democratic Republic of the Congo, {Egypt}, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Tanzania, Uganda) *Nile	40
Pandaruan (Brunei-Malaysia)	40
Iran and Turkmenistan Joint Management Commission for Doosti Dam (on Harirud) (Iran-Turkmenistan) *Hari/Harirud	33.33
Kura-Araks* (Azerbaijan-Georgia)	33.33
Russian-Kazakh Intergovernmental Commission on Joint Use and Protection of Transboundary Water Courses (Kazakhstan-Russia)	28
Technical Working Group (Bulgaria-Turkey) *Maritsa	23.33
Russian-Kazakh Intergovernmental Commission on Joint Use and Protection of Transboundary Water Courses (Kazakhstan-Russia) *Ob	23.33
Atrak (Iran-Turkmenistan)	20

Joint Permanent Water Commission for Buzi, Pungwe and Sabi River Basin - BuPuSa (Mozambique-Zimbabwe)	20
Helmand River Delta Commission (Afghanistan-Iran) *Helmand	20
Kazakhstan-China Joint Commission in the Field of Use and Protection of Transboundary Rivers (China-Kazakhstan) *Ili/Kunes He	20
Permanent Indus Commission between India and Pakistan (India-Pakistan) *Indus	20
Kura-Araks* (Iran-Azerbaijan)	20
Lake Prespa (Albania, Greece, Macedonia)	20
Kazakhstan-China Joint Commission in the Field of Use and Protection of Transboundary Rivers (China-Kazakhstan) *Ob, *Pu Lon T'o	20
Ruvuma River Joint Water Commission - JWC (Mozambique-Tanzania)	20
Yarmouk* (Jordan-Syria)	20
Maritsa* (Greece-Turkey)	16.67
Samur (Azerbaijan-Russia)	16
Joint Technical Committee - Tigris (Iran-Iraq) *Tigris	13.33
Umbeluzi (Mozambique-Swaziland)	13.33
Joint Boundary Water Commission (JBWC) (Georgia-Turkey)	12
Permanent Greek-Albanian Commission on Transboundary Freshwater Issues (Albania-Greece)	12
Interstate Commission of Armenia and Turkey on the Use of Akhuryan Water Reservoir (Akhuryan River flows in to Aras); Joint Technical Committee to Manage Dam between Turkey and Armenia on Arpacay River (Armenia-Turkey) *Kura-Araks	6.67
Kura-Araks* (Georgia-Turkey)	6.67
An Nahr Al Kabir (Lebanon-Syria)	4
Mono River Basin Authority (MBA) (Benin-Togo)	4
Asi/Orontes* (Lebanon-Syria)	3.33
Komoe-Bia-Tano Basin Authority (Burkina Faso, Côte d'Ivoire, Ghana, Mali)	3.33
Cavally-Cestos-Sassandra Basin Authority (Côte d'Ivoire, Guinea, Liberia)	3.33
Tigris-Euphrates* (Iraq-Syria)	3.33
Tigris-Euphrates* (Turkey-Syria)	3.33
Amacuro, Barima (Guyana-Venezuela)	0
Aral Sea* (Afghanistan-Tajikistan)	0
Aral Sea* (Afghanistan-Turkmenistan)	0
Aral Sea* (Afghanistan-Uzbekistan)	0
Asi/Orontes* (Syria-Turkey)	0
Astara Chay (Azerbaijan-Iran)	0
Daoura, Dra, Guir, Oued Bon Naima, Tafna (Algeria-Morocco)	0
Digul, Fly, Jayapura, Maro, Sepik, Tami, Tjeroaka/Wanggoe, Vanimo-Green (Indonesia-Papua New Guinea)	0
Drin (Albania, Macedonia, Montenegro, Serbia)	0
Essequibo (Guyana, Suriname, Venezuela)	0
Gash (Eritrea, Ethiopia, Sudan)	0
Hamun-i-Mashkel/Rakshan (Afghanistan, Iran, Pakistan)	0
Hari/ Harirud*, Kowl E Namaksar (Afghanistan-Iran)	0
Helmand*, Indus* (Afghanistan-Pakistan)	0
Ili/Kunes He* (Kazakhstan-Kyrgyzstan)	0
Jordan River* (Israel-Lebanon)	0
Juba-Shibeli (Ethiopia, Kenya, Somalia)	0
Kura-Araks* (Armenia-Azerbaijan)	0
Murgab (Afghanistan-Turkmenistan)	0
Yarmouk* (Israel-Syria)	0

* The river is covered by multiple river basin authorities and/or relationships.
Source: SFG, Water Cooperation Quotient 2017, Strategic Foresight Group, Gourishankar Kothari and Company, 2017.
Notes: Following 33 watercourses that include at least one OIC country were excluded from evaluation for various reasons, such as lack of reliable information or lack of significance for the riparians or one of the riparians (some riparian countries consider a river insignificant because it is seasonal, or located in a very remote area): Akpa (Cameroon, Nigeria); Atui (Mauritania, Western Sahara); Awash (Ethiopia, Djibouti, Eritrea, Somalia); Bahukalat (Iran, Pakistan); Bangau (Brunei, Malaysia); Baraka (Eritrea, Sudan); Benito/Ntem (Cameroon, Equatorial Guinea, Gabon); Corantijin/Courantyne (Guyana, Suriname, Brazil); Cross (Nigeria, Cameroon); Dasht (Pakistan, Iran); Great Scarcies (Guinea, Sierra Leone); Lake Turkana (Ethiopia, Kenya, S. Sudan, Uganda); Little Scarcies (Sierra Leone, Guinea); Loes (Indonesia, Timor-Leste); Loffa (Liberia, Guinea); Lotagipi Swamp (Kenya, Sudan, S. Sudan, Ethiopia, Uganda); Mana-Morro (Liberia, Sierra Leone); Maroni (Suriname, French Guiana, Brazil); Mbe (Gabon, Equatorial Guinea); Medjerda (Tunisia, Algeria); Moa (Sierra Leone, Guinea, Liberia); Nahr El Kebir (Syria, Turkey); Nyanga (Gabon, Republic of the Congo); Ogooue (Gabon, Republic of the Congo, Cameroon, Equatorial Guinea); Oueme (Benin, Nigeria, Togo); Sanaga (Central African Republic, Cameroon, Nigeria); Sebuku (Indonesia, Malaysia); Sembakung (Indonesia, Malaysia); St. John - Africa (Liberia, Guinea); St. Paul (Liberia, Guinea); Tarim (China, Kyrgyzstan, Pakistan, Tajikistan, Afghanistan); Utamboni (Gabon, Equatorial Guinea) and Wadi Al Izziyah (Lebanon, Israel).

As listed in the table, the Organization for Development of the Senegal River - OMVS (Guinea, Mali, Mauritania, Senegal), the Gambia River Basin Development Organization - OMVG (Gambia, Guinea, Guinea-Bissau, Senegal) and the Niger Basin Authority - NBA (Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Guinea, Mali, Niger, Nigeria) got the full score (100) in Water Cooperation Quotient Ranking 2017.

Scores of 21 shared watercourses related to the OIC Member States are above 50, indicating that they have a relatively peaceful and stable relationship with each other. They may have diplomatic issues or disagreements, but zero risk of war. Scores of 5 watercourses are between 23.33 and 50, which show that related countries are developing their water cooperation, which is still far from satisfactory level. Unfortunately, 47 shared watercourses that concern the OIC have scores below 23.33, pointing out that there is lot of things to be done to start or expand transboundary water cooperation. In this context, as shown in Figure 5.16, it is important to understand that good practices exist and that they should be studied and lessons learned implemented. For example, Senegal, an OIC Member State that has developed an effective model of active and peaceful cooperation with its neighbouring countries in the field of transboundary fresh waters, could be very useful in this direction.

In conclusion, it should be highlighted that issues related to water scarcity and the linkages between water, peace and security are not new to the OIC countries. However, since demand for fresh water is expected to increase in the next few decades, in combination with factors that are negatively affecting countries' fresh water supply capacities, providing enough fresh water for people and different sectors will remain as a critical issue for many OIC Member States. This means that for ensuring water security, investing more and more effectively in water-related infrastructure is necessary. Otherwise, water insecurity can lead to the consequences such as food and energy shortages, poverty, biodiversity loss and an increased threat of conflict.

Figure 5.16: Good Practices in Transboundary Water Cooperation

Source: UNESCO

By investing in sustainable water infrastructure and capitalizing on advances in science, technology and engineering that have improved effectiveness in areas such as water harvesting, desalination and wastewater treatment, the OIC Member States can significantly improve their water security. Still, for this to happen, major shifts in water management are required, including securing and protecting water resources through adapting a cross-sectoral approach and implementation of integrated water resources management. An important aspect of this is to ensure that decision-making is done transparently in an accountable and inclusive manner, while engaging different levels of governance (local, basin, regional and national) and enabling consultations across public and private institutions and civil society. Otherwise, failures in water management may pave the way for more dramatic water shortages.

CHAPTER SIX

Implementation of the OIC Water Vision

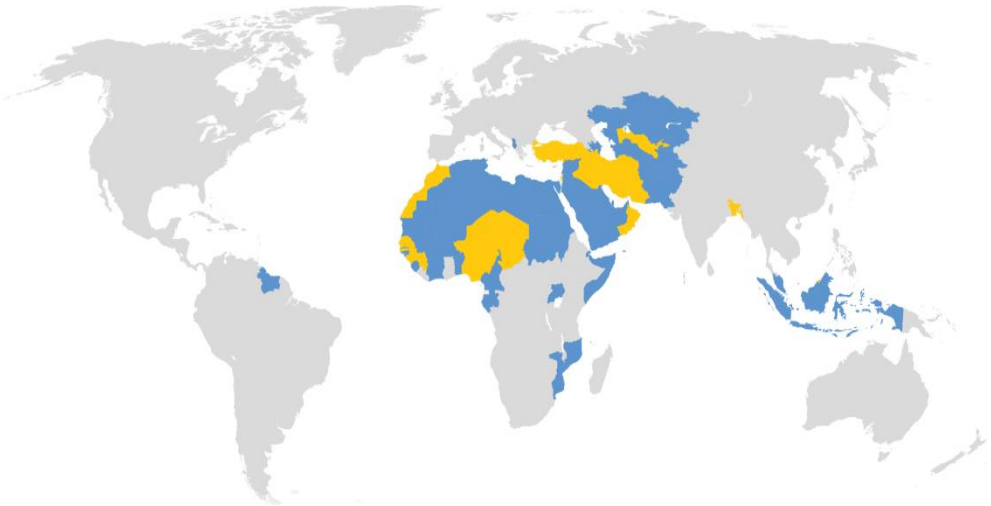
Over the decades, the OIC has worked to address directly major issues of environmental and social concern such as clean water availability and access to sanitation and, following a direct request from the OIC Water Ministers, the OIC General Secretariat began the process of developing a common vision to address water issues up to the year 2025. Following deliberations at meetings of an Advisory Panel of Experts in Dubai in May 2010 and Astana in June 2011, a draft vision was developed that was later presented to wider communities within the OIC for consultation. The OIC Water Vision was then adopted by the 2nd Islamic Conference of Ministers Responsible for Water held in Istanbul in 2012. The OIC Water Vision is a framework of cooperation among OIC member countries, relevant OIC institutions and international organizations in the water sector to improve availability of water particularly potable water in OIC countries. It aims to catalyse improved water security in OIC countries through connecting centres of excellence within the OIC in water science, policy, management and technology development; identifying solutions to water problems through increased dialogue and exchange of experience; and promoting solutions to water security challenges in the national and international agendas of OIC leaders. The 3rd Islamic Conference of Ministers Responsible for Water held in Istanbul in 2016 approved the terms of reference for establishing the OIC Water Council. The First Meeting of the OIC Water Council was held in Istanbul in November 2017, and in that meeting an implementation plan for the OIC Water Vision was developed.

Since the adoption of the OIC Water Vision, in 2012, the OIC General Secretariat in collaboration with the Turkish Water Institute (SUEN) and the Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC) conducted the first wave of surveys on the implementation of the OIC Water Vision and future cooperation activities, whose results were reported in the OIC Water Report 2015 and presented to the 3rd Islamic Conference of Ministers Responsible for Water held in Istanbul in 2016. In 2018, OIC General Secretariat and SESRIC administered the second wave of surveys on the implementation plan for the OIC Water Vision amongst OIC countries. The questionnaire aimed at gathering information on the efforts taken to implement OIC Water Vision, identifying key water-related challenges facing OIC countries and actions and strategies to address challenges of water security. In addition to the above aims and in compliance to the request of the OIC Water Council that SESRIC conducts a survey in order to assess the needs and capacities of member states, two new sections were added to the survey carrying the objective of identifying the training needs and capacities of member states and their requirements in terms of water infrastructure. The questionnaire was circulated online through Survey Monkey and emails to 'National Focal Points for the OIC Water Vision' between 23rd April and 30th May 2018.

The questionnaire consisted of four sections (see Appendix A). In the first section, respondents answered 7 questions about achievements and challenges in the implementation of OIC Water Vision. This section aimed at profiling the overall water security challenges of OIC countries including, but not limited to, water resource availability, consumption, infrastructure, financing, trans-boundary water management, and socio-economic and physical climates. In the second section, there were 5 questions aimed at identifying the training needs and

capacities of member states ranging from technological exchange, capacity building, and finance and funding. The third section of the questionnaire consisted of 3 questions investigating the requirements of member states in terms of water infrastructure that needs building or upgrading. And the last section of the questionnaire inquired about the way forward for the OIC countries and their main challenges, priorities and opportunities for the 5-10 years ahead. As of August 2018, 15 OIC countries responded to the questionnaire (see Figure 6.1), corresponding to 26% of OIC member countries with representation from diverse geographical regions.

Figure 6.1: OIC Countries that Responded to the OIC Water Council Survey 2018



Respondent (highlighted) OIC countries are: Kingdom of Bahrain, People's Republic of Bangladesh, Brunei Darussalam, Republic of Chad, Republic of Guinea, Islamic Republic of Iran, Republic of Iraq, Kingdom of Morocco, Republic of Niger, Federal Republic of Nigeria, Sultanate of Oman, State of Palestine, Republic of Senegal, Republic of Turkey, and Republic of Uzbekistan.

6.1 Major Achievements

In most of the countries surveyed (93%), the OIC Water Vision document has already been circulated to the relevant departments and the implementation of various recommended actions and activities is in progress (Figure 6.2(a)). Among the 15 respondents, 14 OIC countries have adopted a water security policy at the national level since 2012. Only Senegal responded negatively about the existence of a comprehensive water policy at national level. Additionally, 9 of the 15 respondents have also updated, and /or evaluated their national policy on water issues since the adoption of the OIC Water Vision in 2012. Only Brunei Darussalam, Nigeria, and Oman did not update or evaluate their existing water security policy; whereas, Chad, Palestine, and Niger provided no information about the update or evaluation of their national water security policy (Figure 6.2(b)).

Figure 6.2(a): Has Your Country Adopted a Water Security Policy at the National Level since 2012?

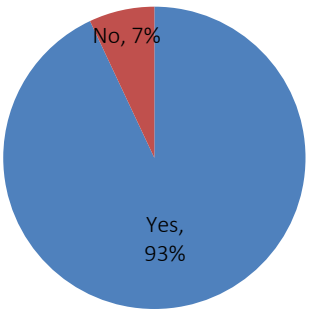
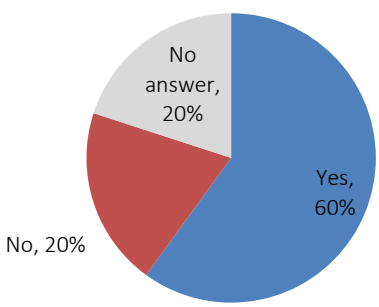
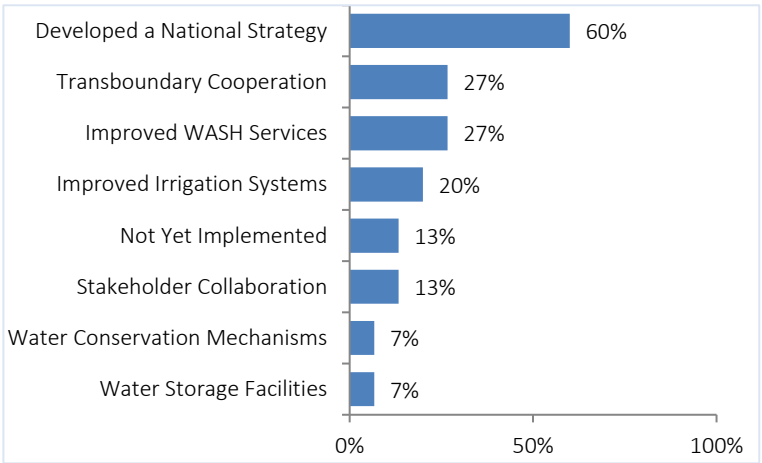


Figure 6.2(b): Has Your Country Updated or Evaluated Existing National Water Security Policy since 2012?



Moreover, since 2012 OIC countries have also undertaken various efforts for the implementation of the OIC Water Vision in their respective countries. As shown in figure 6.3, 60% of the survey respondents have developed a national strategy and/or plan as an effort towards the implementation of OIC Water Vision in their countries. A further 27% of the respondent countries actively undertook efforts towards transboundary cooperation and improving access to (safe) drinking water and sanitation services as a part of their efforts to implement the OIC Water Vision in their countries. Other efforts undertaken for the implementation of OIC Water Vision include improved irrigation systems (20%), improved stakeholder collaboration on water-related issues (13%), and improvement in water conservation mechanisms and water storage facilities (7%). Only Bangladesh and Palestine responded that the implementation process of the OIC Water Vision had not yet begun in their countries.

Figure 6.3: Efforts Undertaken for the Implementation of the OIC Water Vision in Your Country



In line with the efforts towards the implementation of OIC Water Vision, respondent countries also experienced major achievements and/or breakthroughs while implementing OIC Water Vision in their countries – as summarized in table 6.1 (below). The experiences and achievements of each respondent country are diverse in nature and scope. For instance, Bahrain successfully implemented the principles of water integrated management, Chad, Guinea, and Senegal improved their water and sanitation services, Iran and Turkey made positive development in the field of irrigation, Oman conducted a breakthrough study on their water resources, and Uzbekistan successfully cooperated with its neighbours over the joint use of Amudarya and Syrdarya rivers. Reporting the experiences and achievements of respondent countries is important because such initiatives can be replicated by other OIC member countries customized in accordance to their local needs through an exchange of expertise and knowledge. Knowledge sharing and exchange can also strengthen intra-OIC cooperation and partnerships aiming to resolve common water-related issues.

Table 6.1: Major achievements and/or breakthroughs while implementing the OIC Water Vision in Respondent Countries

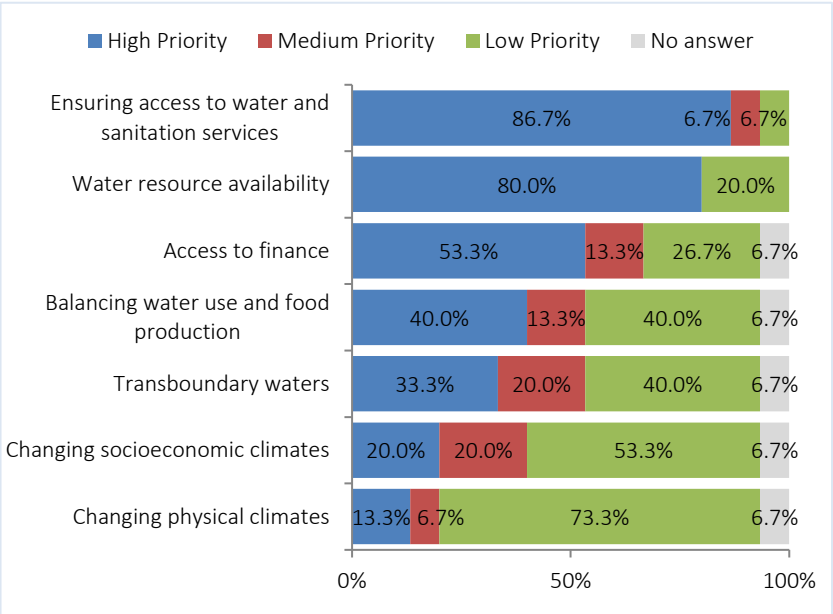
Country	Achievements/Breakthroughs
Bahrain	Implemented the principles of water integrated management.
Chad	Improved the rate of access to water from 21% in 2000 to 53% in 2015.
Guinea	Improved the design of drinking water supply and sanitation projects.
Iran	Updated the National Irrigation Act (NIA) focusing on Participatory Irrigation management. Introduced training for operators and staff in institutions partnering with the Ministry of Agriculture.
Iraq	Participated in the Water Council.
Senegal	Improved WASH services, hydro-agriculture and small-scale irrigation, and the framework for water resource management.
Nigeria	Most of the work in this area is still in preliminary stage.
Oman	Developed and modernized hydrometric monitoring network, implemented exploratory drilling and pilot pumping programme, and also commissioned a study on water situation.
Turkey	Examined the impact of irrigation management on agro-industries and rural-urban migration.
Uzbekistan	Successfully cooperated with neighbouring countries over the joint use of Amudarya and Syrdarya regulated by a UN Convention and improved the efficiency of irrigation technologies.

6.2 Major Challenges

In spite of geographical and environmental diversity, respondent countries exhibit commonalities in their prioritization of water security related challenges listed in the OIC Water Vision. As shown in Figure 6.4, ensuring access to water and sanitation services is the greatest challenge to the water security of 87% of the respondents. It is followed by challenges

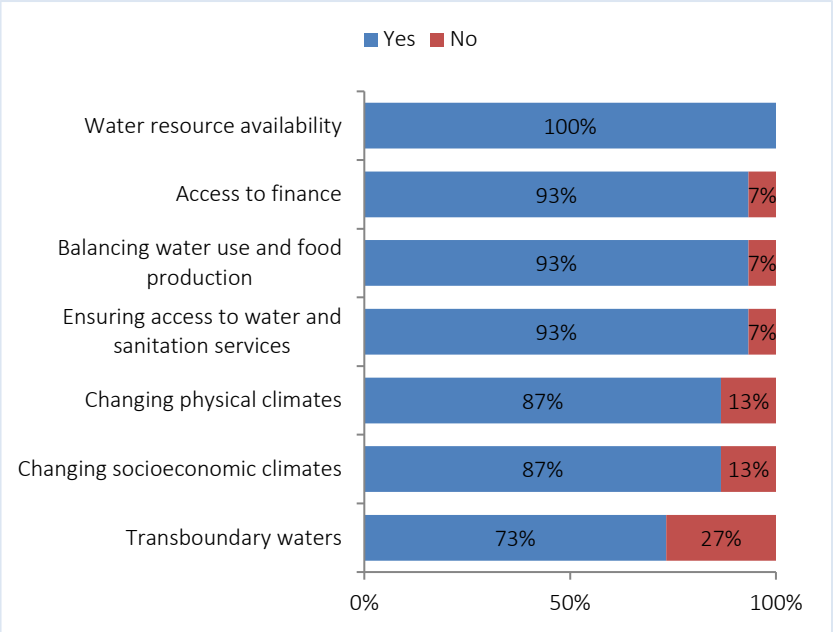
associated with water resource availability (80%), access to finance (53%), balancing water use and food production (40%), transboundary waters (33%), and changing socio-economic climates (20%). At the other end of the scale, changing physical climates is not as big of a challenge for 73% of the respondents.

Figure 6.4: Please Rank the Following Water Security Challenges from the OIC Water Vision



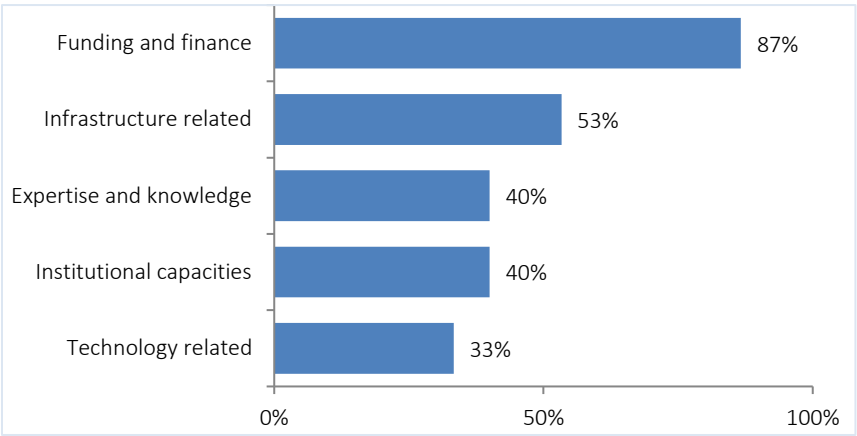
The results of the questionnaire reveal that majority of the respondents have specific policies, strategies and /or action to address all seven major water security challenges listed in the OIC Water Vision. As shown in Figure 6.5, 100% of the respondents have a policy to address the water resource availability related issues, 93% for access to finance, balancing water use and food production, and ensuring access to water and sanitation services. Concurrently, 87% of the respondents have a policy to address the challenges of changing socio-economic and physical climates. At the other end of the scale, 73% of the respondents have a policy to address transboundary water-related issues. Among the respondents, nine countries namely: Bangladesh, Guinea, Iran, Iraq, Senegal, Palestine, Niger, Turkey, and Uzbekistan reported having specific policies, strategies and /or action to address the all major challenges listed in the OIC Water Vision.

Figure 6.5: Has Your Country Developed Specific Policies, Strategies, or Actions for the Following Water Related Challenges?



It is a widely held opinion that financial, institutional, technological, expertise/knowledge, and infrastructure related difficulties and obstacles are hindering the developing world, including many OIC countries, in achieving a water secure future. This is also the case for majority of the 15 respondents. As shown in figure 6.6, 87% of the respondents reported facing major obstacles in funding and financing their efforts for implementation of the OIC Water Vision. More than half of the respondents (53%) faced major infrastructural obstacles in implementing the OIC Water Vision. Further 40% of the respondents identified obstacles related to expertise/knowledge and institutional capacities; whereas, only 33% of the

Figure 6.6: Main Difficulties and Obstacles in the Implementation of the OIC Water Vision



respondents mentioned technology as a major obstacle in implementing the OIC Water Vision. At individual country level, all of these five obstacles are a major concern for Senegal and Nigeria. However, for Brunei Darussalam and Bahrain, none of these obstacles are a major concern.

6.3 Technical Assistance and Capacity Building

There is a widespread acknowledgement that south-south cooperation has the potential to play an important role in bridging the gap between developing countries by facilitating the exchange of information and transfer of knowledge and expertise. Results of the questionnaire reveal that there is an increasing level of awareness as well as willingness among the OIC member countries to achieve water security through assistive capacity building, transfer of technology, and funding – as shown in Figure 6.7. Though funding was recognized as one of the major obstacles in the implementation of the OIC Water Vision, none of the respondents are able to help in the form of funding initiatives. Meanwhile, 80% of respondents showed interest in offering capacity-building programmes to other OIC countries and almost half of the respondents (47%) expressed their readiness to help other OIC countries to achieve water security by facilitating technology transfer.

Figure 6.7: Assistance your Country can Offer in Achieving Water Security

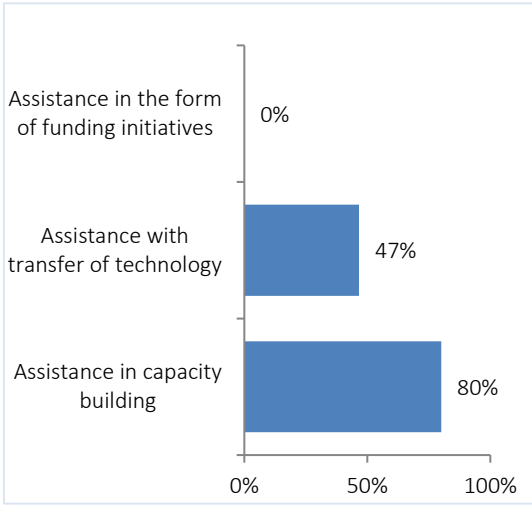
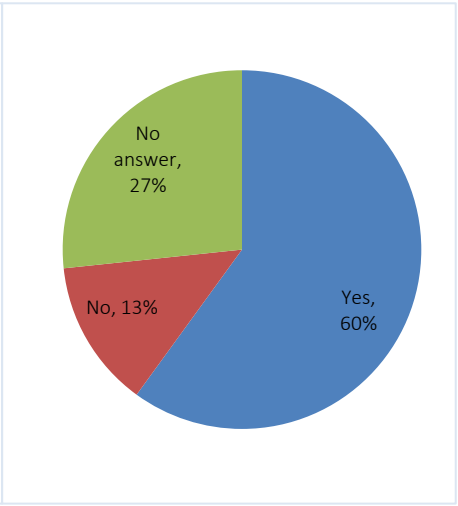


Figure 6.8: Has your country cooperated with another OIC country in an exchange programme to share information and experience?



However, even when the majority (80%) of the respondents showed interest in offering capacity-building programmes to other OIC countries, only 60% of the respondents have cooperated with another OIC country in an exchange program to share information and experience till date (Figure 6.8). These programs pre-dominantly include exchanges on the topic of transboundary water issues or in the form of capacity building programs (trainings and

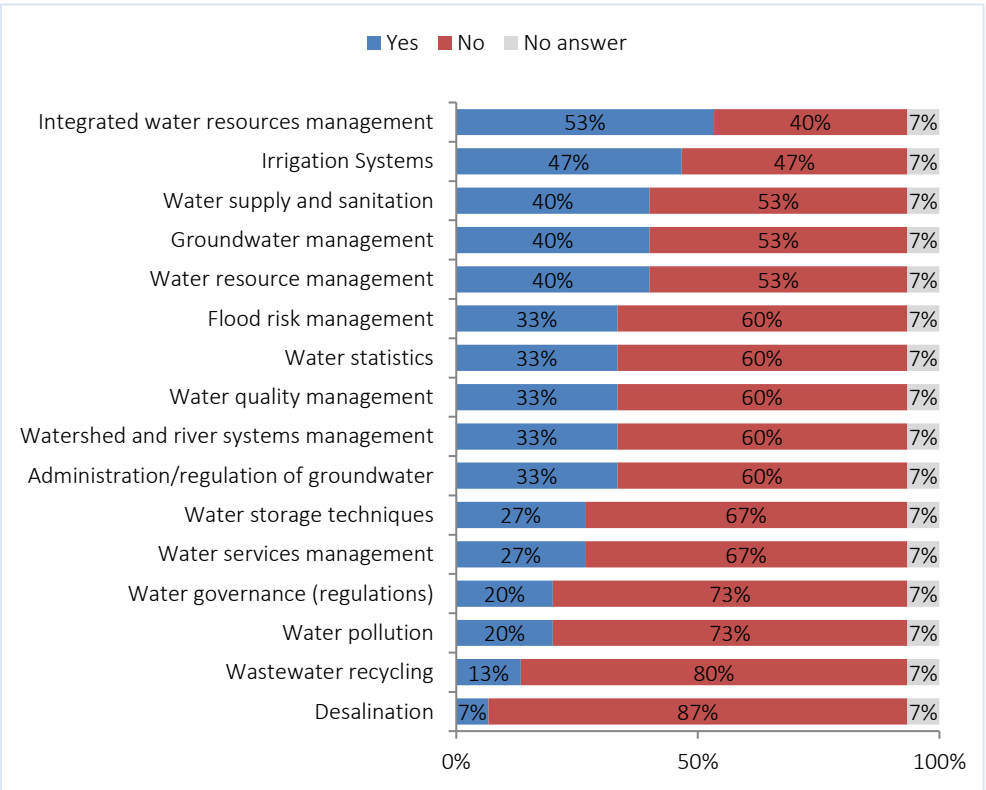
knowledge sharing) between member countries. A brief overview of cooperative exchanges of 9 respondent countries is presented in table 6.2 below. Notably, Bangladesh and Nigeria have not cooperated with another OIC country in an exchange program whereas, Brunei Darussalam, Bahrain, Morocco, and Niger provided no information about cooperation through exchange programs with other OIC countries.

Table 6.2: Intra-OIC Cooperation and Exchange Programs in Respondent Countries

Country	Cooperation/Exchange Program Name
Chad	Transboundary waters - continuous cooperation in promoting and participating in the design and operation of common works and projects. Participating countries are: Niger, Nigeria, Cameroon, Libya, CAR and Chad for the Lake Chad Basin Commission (LCBC); Guinea, Côte d'Ivoire, Mali, Burkina-Faso, Benin, Niger, Nigeria, Cameroon and Chad for the Niger Basin Authority (NBA); Egypt, Libya, Sudan and Chad for Joint Authority for the Study and Development of the Nubian Sandstone Aquifier System (JASAD).
Guinea	Capacity building - Guinea Water Society has signed memorandum of agreements to train the company's executives with the following countries: Burkina Faso, Tunisia, and Morocco. There is also a memorandum of agreement between Guinea and Algeria related to the implementation of IWRM (GIRE).
Iran	Irrigation Systems - exchange programme about Participatory Irrigation management and cooperation with Irrigation and Drainage Committee members.
Iraq	Transboundary waters - cooperation with the neighbouring countries Turkey, Iran and Syria in the field of exploiting the shared water resources, but did not live up to the level of agreements required to determine water quotas for each country.
Senegal	Capacity building - training programs are offered to the government to countries including Egypt, Morocco, Algeria, Tunisia. There is also research and development projects with training components for the institutions that participate in these projects
Oman	Capacity building - Human Resources Development Centre
Palestine	Capacity building - cooperation in the field of training, capacity-building and exchange of information and expertise by virtue of MoUs concluded with a group of member states
Turkey	Capacity building - DSI implemented theoretical training in the office and practical training in the field for 6 Ethiopian engineers in 2008. Trainings on Water Resources Management were organized in Turkey in 2010, 2014, 2017 for total 30 water experts from Ethiopia. Trainings of Water Resources Management were organized in Turkey in 2006, 2007, 2008 for total 35 water experts from Egypt, Mali, Zambia, Nigeria, South Africa, Burkina Faso, Ivory Coast and Morocco, as well as in 2011, 2012 and 2013 for total 28 water experts from Mali, Nigeria, Burkina Faso, and Morocco. Training of Water Resources Management were organized in Turkey for total 10 water experts from Uganda, Senegal, Mauritania, Somali in 2016.
Uzbekistan	Transboundary waters - local experts actively participate in realizing joint regional projects.

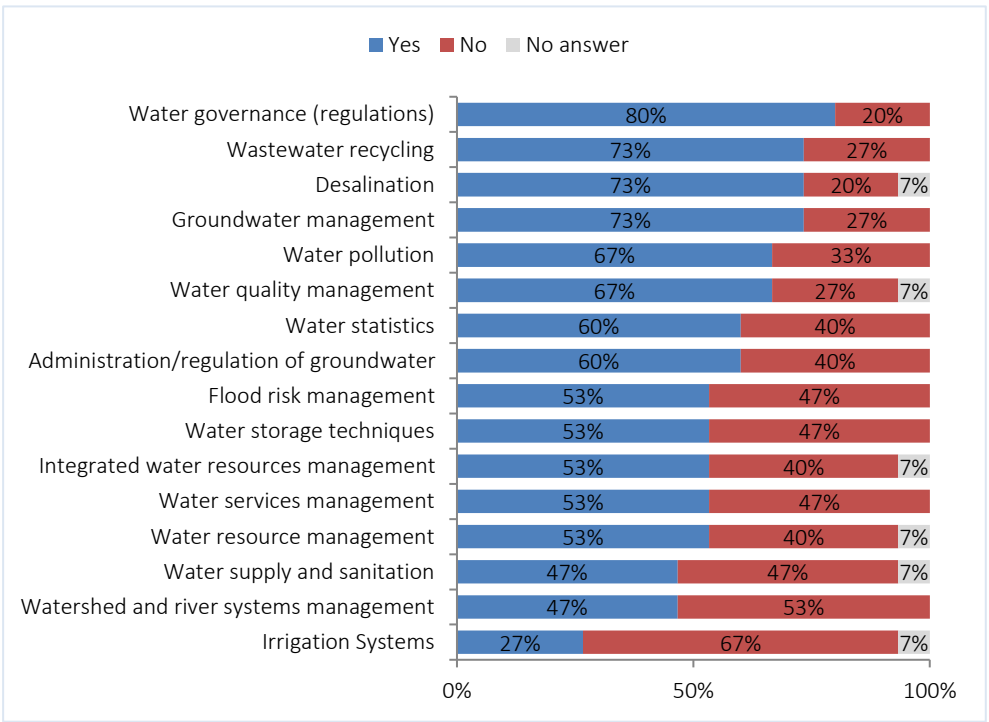
The questionnaire also enquired into various water-related trainings that OIC countries can offer or need. With the exception of Brunei Darussalam, Chad, and Guinea all the respondents identified various water-related trainings that they can offer to other OIC countries as shown in Figure 6.9. None of the countries offered trainings in all the areas due to a lack of capability, experience, or expertise. Notably, Senegal is willing to offer trainings in all the areas except desalination, whereas, Palestine can only offer trainings in water governance (regulations). Generally, the types of trainings offered by respondent countries are varied. From a list of 16 water-related training areas, more than half of the respondents were willing to offer trainings in integrated water resources management (53%). A significant number of respondents were also willing to offer trainings in areas including: irrigation systems (47%), water supply and sanitation (40%), groundwater management (40%), and water resource management (40%). On average, five respondents (each) were willing to offer trainings on flood risk management (33%), methods of water data and information collection (water statistics) (33%), water quality management (33%), watershed and river systems management (33%), and administration and regulation of groundwater (33%). And overall, there were not as many respondent countries willing to offer trainings on water storage techniques, water services management, water governance, water pollution, waste water recycling, and desalination.

Figure 6.9: Please Indicate if Your Country can Offer Training in the Following Areas



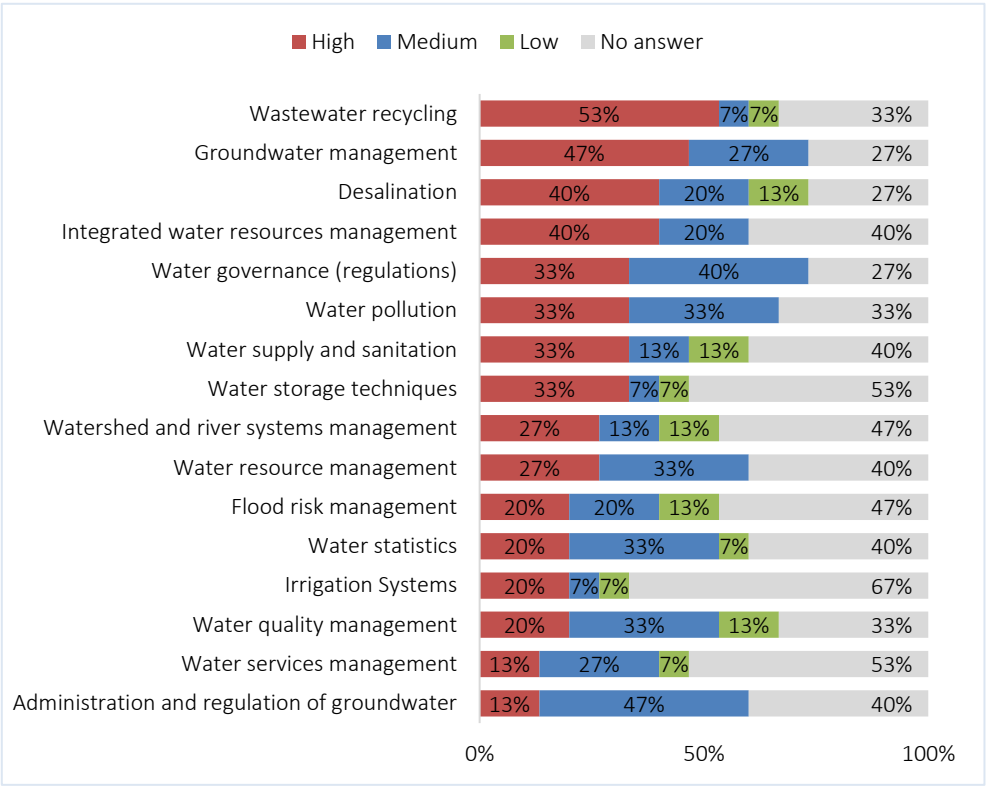
In respect to the training needs of respondent countries, more than half of respondents identified the need for trainings in 13 of the 16 water-related issue areas. Among 15 respondent countries, only Turkey declined the need for training in every water-related issue area. On the other hand, Guinea, Nigeria, and Senegal needed trainings in all 16 areas. The most common training needs for respondent countries were in the areas of water governance (80%), wastewater recycling (73%), desalination (73%), and groundwater management (73%). As shown in Figure 6.10, between 50% and 70% of respondents also needed trainings on water pollution (67%), water quality management (67%), methods of water data and information collection (water statistics) (60%), administration and regulation of groundwater (60%), flood risk management (53%), water storage techniques (53%), integrated water resources management (53%), water services management (53%), and water resource management (53%). To add, almost half the respondents also reported a need for trainings in areas of water supply and sanitation (47%) and watershed and river systems management (47%). On the other hand, the fewest number of respondent countries needed training in irrigation systems (27%). Overall, the high number of responses for each training areas reflects on the dire need for better training and capacity building activities amongst OIC countries on a diverse range of issues. An analysis of responses presented in Figure 6.9 and Figure 6.10 shows a correspondence between trainings needed and offered by respondent countries. Corresponding areas of training needs and offerings can help policy makers identify areas of potential intra-OIC partnerships and future capacity building programs and exchanges.

Figure 6.10: Please Indicate of Your Country Needs Training in the Following Areas



However, even as respondent countries' have substantial needs for water-related trainings; there is a discrepancy between trainings needs and their prioritization amongst respondent countries. The priority accorded to each training area by respondent countries deserves due consideration when policy makers plan water-related strategies, policies, and activities at national, regional, and international level. As shown in Figure 6.11, 53% of the responses ranked wastewater recycling as a training need of the highest priority followed by groundwater management (47%), desalination (40%), and integrated water resources management (40%). Although a large percentage of respondent countries identified water governance as a training need, the difference in each country's priorities is evident from the fact that only 33% respondents categorized water governance as a high priority need. Along with water governance, respondent countries' training needs for water pollution (33%), water supply and sanitation (33%), and water storage techniques (33%) were also ranked lower on the priority scale. Similarly, between 20% and 30% respondents categorized watershed and river systems management, water resource management, flood risk management, methods of water data and information collection (water statistics), irrigation systems, and water quality management as high priority training needs. Lastly, training needs for irrigation systems and administration and regulation of groundwater were of the lowest priority for respondent countries.

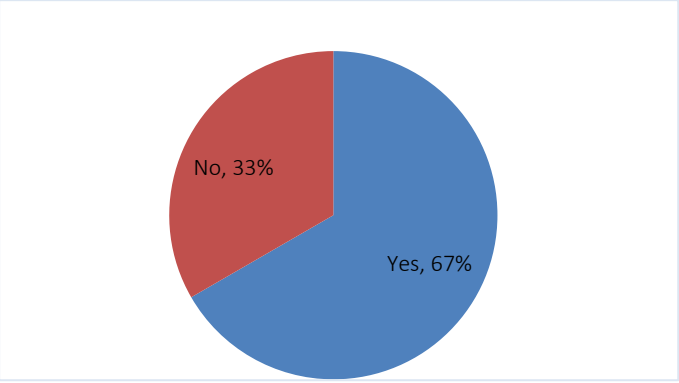
Figure 6.11: Please Indicate the Priority of Your Country's Training Needs in the Following Areas



6.4 Development Assistance

Among the 15 countries that have completed the questionnaire, 67% countries currently lack financial means to build or upgrade necessary water infrastructure (Figure 6.12). A large part of water infrastructure that needs building and upgrading in respondent countries is related to their irrigation systems, watershed and river systems management, and water supply and sanitation to rural and urban areas.

Figure 6.12: Does your Country lack Financial Means to Build or Upgrade Necessary Water Infrastructure?



Other water infrastructure requiring upgrades included, but is not limited to, water storage techniques, integrated water resources management, groundwater management, water governance, flood risk management, desalination, etc. (Table 6.3). While the need to build or upgrade water infrastructure is heavily reliant on the geographical, environmental, and financial conditions in each country, only five countries, namely Brunei Darussalam, Bahrain, Iran, Niger, and Turkey reported having the financial means to build or upgrade necessary water infrastructure in their respective countries.

Table 6.3: Projects in Respondent Countries that need funds and financing for upgrading and building water related infrastructure

Projects that need upgrading:	
Bangladesh	1. Capital Dredging of River Systems in Bangladesh
	2. Ganges-Kobadak (G-K) Irrigation Project
	3. Buriganga River Restoration project
	4. Early Flood Protection and Improvement of Drainage system in Haor Area
	5. Coastal Embankment Project
Chad	1. Project for the Rehabilitation of Water Supply Structures in Urban Centres (PRCU)
	2. Villages and Pastoral Hydraulics' Project

	3. Drinking Water and Sanitation Supply Project in Rural and Semi-rural Areas
	4. Pastoral Hydraulic Facilities Improvement Project
	5. Drinking Water and Sanitation Supply Project in Secondary Urban Centres
Guinea	1. Drinking water supply implementation Project for the city of Conakry (fourth Water Project of Guinea)
	2. Interior cities Rehabilitation and implementation Project of AEP
	3. Rehabilitation and extension Project of the Guinea Water courses hydrological stations
Iran	1. Development of irrigation and drainage network
	2. Development of modern irrigation system
	3. Restoration and restoration of Qanats
	4. Development of rice field
	5. Agricultural water use and demand management
Iraq	1. Construction of hydroelectric dams and expansion of hydroelectric power
	2. Implement the central and southern part of East Tigris well drain
	3. Construction and installation of stations for measuring river flows
	4. Institutional and legislative reform
	5. Construction of a weir in Muthanna province
Oman	1. Identifying the water needs for the main agricultural crops
	2. Improve the efficiency of the irrigation systems
	3. Monitoring the actual withdrawal rates of groundwater for agricultural purposes
Palestine	1. Developing the sewage system for northern Gaza
	2. Rehabilitation of networks and reservoirs in the southern West Bank
	3. Rehabilitation and restructuring of the internal networks of the northern and southern Gaza Strip
	4. Development and rehabilitation of the sanitation system for southern Jerusalem and East Bethlehem
	5. Development of the sanitation system in the city of Jenin
Senegal	1. PEPAM : Millennium Project of drinking water and sanitation
	2. CADEX and the SODAGRI Projects
Uzbekistan	1. Modernization of existing pumping stations to improve water availability of irrigated lands
	2. Increasing the irrigated lands water security by improving the technical condition of the main canals

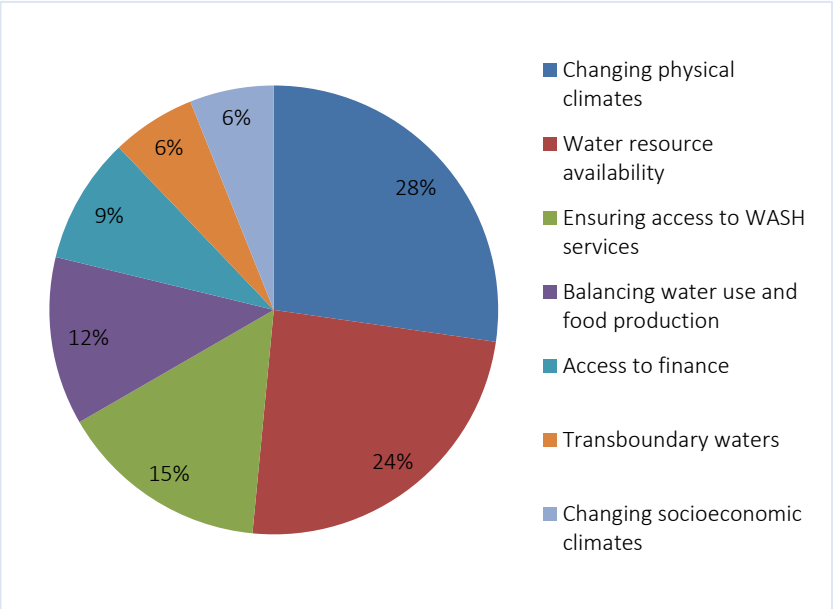
	3. Strengthening the capacity of water users' associations to improve the efficiency of water resources usage
	4. Improving the reclamation condition of irrigated lands in dry conditions of Uzbekistan
Projects that need building:	
Bangladesh	1. Ganges/Padma Barrage Project
	2. Brahmaputra Multi-purpose Barrage Project
	3. Bangladesh Delta Plan 2100
	4. Systematic Rehabilitation of the Coastal Polders
	5. Sustainable Capital Dredging of the vulnerable river systems in Bangladesh
Chad	1. Pastoral and Village Hydraulics Program in the Wadi-Fira Region (PHPVW)
	2. Project of the achievements of the Deep Drilling in the Nubian Sandstone Zone (PRFP-GN)
	3. Drinking water supply optimization project (POAEP - CU) of six urban centres: Biltine, Mao, Moussoro, Amdjarass, Mongo, Oumhadjar
	4. Drinking Water Supply and Sanitation Program in rural Ouaddaï-Biltine (PAEPOB)
	5. Pastoral Hydraulics Project in the Geographical Ouaddaï (PHPOG)
Guinea	1. Construction project of 13000 water points and 6000 latrines in rural areas
Iran	1. Soil and water conservation projects
	2. Climate change project
Iraq	1. Rehabilitation of the Mosul dam, which is suffering from gypsum loss which is currently being filled
	2. Rehabilitation of the irrigation channel Samra - Tharthar to increase discharge from 100 to 250 m^3/s
	3. Rehabilitation of the general estuary
	4. Rehabilitation of hydroelectric dams to improve their efficiency and increase their production
	5. Development of forest and green belt programs to reduce desert encroachment and reduce dusty storms
Morocco	1. Desalination plant to supply the city of Casablanca with drinking water
	2. Desalination plant to supply the city of Nador with drinking water
	3. Water diversion project from northern water basins to southern basins
Oman	1. Increase in the installation of modern irrigation systems
	2. Rainwater harvesting through building some dams and water reservoirs
	3. Use of treated wastewater in the irrigation of the economic crops

	4. Promotion of water resources through the implementation of the rainmaking project
	5. Use of modern techniques to reduce salinity levels in the wells that are used for irrigation purposes
Palestine	1. Establishment of tanks, conveyor lines and regional water pumping stations for bulk distribution in the governorates of the south, central and northern West Bank
	2. Construction of the northern pipeline for Gaza Strip to serve the central governorates, Gaza and the north
	3. Construction of sewage network for Khan Younis Governorate and development of treatment plant
	4. Establishment of an integrated sewage system for the north west of Jenin Governorate
	5. Establishment of a sewage system for the south of Tubas governorate
Senegal	1. PREFELAG : Project for the restoration of the lake Guiers ecological functions
	2. PUDC : Emergency program of Community Development
	3. PNDIL : National Program for the development of small local irrigation
Uzbekistan	1. Increasing the efficiency of water resources usage on the basis of development and introduction of water-saving irrigation technologies

6.5 Challenges, Priorities, and Strategies for the Future

The last section of the questionnaire enquires the main challenges, priorities and strategies for the coming 5-10 years to address the issue of water security in OIC countries. With the exception of Bahrain, Iran, Iraq, and Nigeria, the question related to the main challenges was answered by all the respondents. With respect to respondent countries, as shown in Figure 6.13, changing physical climates (28%) and water resource availability (24%) were identified as the major challenge to water security followed by ensuring wider access to the water and sanitation services (15%), balanced water use and food production (12%), and access to finance (9%). Bangladesh and Uzbekistan were the only respondent countries to identify transboundary waters as a main challenge to water security. Whereas, Chad and Niger were the only two countries citing changing socio-economic climates as a main challenge to their countries water security in the future.

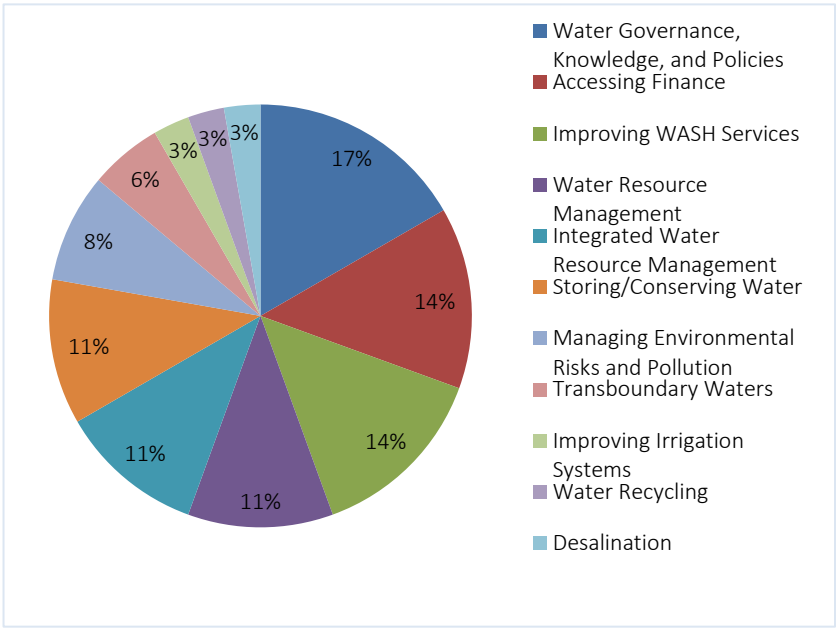
Figure 6.13: Main Challenges Affecting Water Security in Your Country in the Future



On a similar note, development and adoption of water governance, knowledge on water-related topics, and water-related policies was identified as the main priority by 17% of the respondents in order to ensure a water secure future for their countries – as shown in Figure 6.14. Among 15 respondent countries, 14% stated that their main priorities were to access finance and improve water and sanitation services in their countries.

Furthermore, only a few respondent countries identified their main priorities as water resource management (11%), integrated water resources management (11%), water conservation and storage techniques (11%), managing water pollution and environmental risks (8%), transboundary waters (6%), improving irrigation systems (3%), waste water recycling (3%), and desalination (3%). Out of 15 respondents, Bahrain, Iraq, and Nigeria were the only respondent countries who did not state their main priorities in response to this question.

Figure 6.14: Main Priorities that can Ensure a Water Secure Future



Overall, out of 15 respondents of the questionnaire, 66% of countries indicated that they have strategies for achieving water security to be carried out at the national level over the next 5-10 years (Figure 6.15). While Chad responded negatively to the question, Bahrain, Iraq, Nigeria, and Senegal refrained from answering it. As shown in Table 6.4 below, almost two thirds (67%) of the respondents have indicated that they are bound to national, regional, and/or international commitments to achieve water security targets in the next 5-10 years (Figure 6.16). These water security targets included, but are not limited to, at least one of the following issues: improving the accessibility of safe drinking water and sanitation services, accessing finance and funding for water-related projects, integrated water resources management, transboundary water issues, developing a national strategy/plan for water use and management, and building water storage and conservation facilities.

Figure 6.15: National Level Strategies for Achieving Water Security over the next 5-10 years

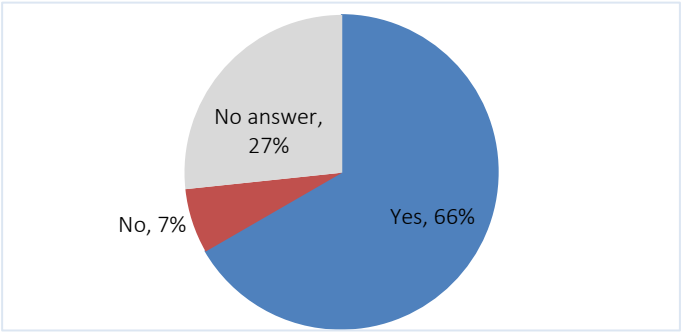


Table 6.4: National Level Strategies for achieving Water Security in the future

Country	National Level Strategy
Bangladesh	The implementation of transboundary Ganges/Padma Barrage Project (Bangladesh-India) to improve socio-economic and environmental conditions of South-West and North-West region.
Brunei Darussalam	Ensuring access to clean and safe WASH services through water supply management, and stakeholder engagement for water conservation.
Chad	Seeking funding for the regional investment plan for hydraulic works.
Iran	Establishing a comprehensive water management system for the based on the principles of sustainable development and land use in the catchment areas of the country, integrated water resource management, water conservation, water storage techniques through dams, aquifer schemes, irrigation networks, flood risk management, improving water statistics, and transboundary water issues.
Morocco	The existing National Water Strategy, National Water Plan, and Directorate Plans of Watershed.
Niger	Mobilization of financial resources strategy.
Oman	The Arab Strategy for Water Security in the Arab World , GCC Unified Water Strategy 2015-2035, National Strategy for Wetlands, National Strategy for Addressing the Problem of Salinity in Oman, and Strategy on Sustainable Agriculture and Rural Development 2040.
Palestine	Developing an operational strategic plan to achieve water security within available resources.
Senegal	Improving access to clean and safe WASH services and irrigation systems for a period beyond the next 5-10 years.
Turkey	Completion of various water storage facilities.
Uzbekistan	Developing transboundary water resource management scheme for Amudarya and Syrdarya river basins.

CHAPTER SEVEN

Concluding Remarks and Policy Implications

OIC countries face a number of water related challenges that are common to a large number of them. On the one hand; population growth, rapid urbanisation, water-intensive patterns of growth and improved living standards are driving demand for water. On the other hand; the hydrologic environment – *the absolute level of water resource availability, its inter- and intra-annual variability and its spatial distribution* – combined with the challenges of pollution, climate change, non-revenue water and changing ecosystems are limiting water availability. In addition, transboundary waters constitute a challenge with respect to their management and efficient, reasonable and equitable use. All of these challenges combined negatively affect water security for many OIC countries.

An integrated water resources management is a precondition for providing water resources and services for all people, uses and sectors, and for conserving water in a sustainable way and protecting water resources from pollution. The first building blocks in water resources management are increasing water availability and managing water demand. Water availability is not restricted to natural factors; human factors play an important role in determining water availability. Thus, specific human interventions can have a role in increasing water availability. Water storage whether in the conventional method of dams, or the less conventional method of underground water storage increase the availability of water on a regular basis and especially in dry seasons were otherwise water would have been absent. Water storage is a prerequisite for allowing the transfer of water from high precipitation regions to low precipitation regions. To supplement the role of dams and underground water storage, water catchments can be deployed. With the construction of more water catchment areas, more rainfall can be collected and made available for use.

The issue of water quality affects water availability. Poor water quality reduces the availability of water of required quality level for given uses. Human activities introduce materials and elements that pollute water such as organic matter, heavy metals, and fertilizers. Therefore, the mind-set used in water resources management needs to seriously consider the issue of pollution control as an important element of water supply management strategies. In this regard, wastewater treatment is essential. In addition, there are different old and new methods that can help to reduce the pollution at source and treat polluted water before it enters waterbodies. For example, through environmental biotechnology, it became possible to use microorganisms from wastewater, to clean up pollution in contaminated waters.

Many of the solutions for increasing water availability require large investments in the already weak water infrastructure in the OIC countries. Failing to do so will hinder attempts by OIC countries to increase water availability. OIC countries need to build up and upgrade their water infrastructure and commit the required finances to do so. In many OIC countries, this is more easily said than done as financing stands as a big challenge as shown by the results of the "OIC Water Council Survey 2018" presented in Chapter Six where more than half of the respondents declared that they lack financial means to build or upgrade necessary water infrastructure in their countries. In this regard, the Resource Mobilization Group under the OIC Water Council has a huge role to play in introducing financing mechanisms for building and upgrading water

infrastructure particularly in the least developed OIC countries. Involving donor agencies, NGOs working under the guidance of national governments, philanthropist organizations as well as international and regional organization who are providing funds for the water related projects in the OIC countries is highly critical for securing the necessary finances.

On the other hand, demand management is more complex as it is dependent on evolving human needs and cultural and societal values. The use and distribution of water in the OIC is sub-optimal as reflected in the low water productivity in OIC countries as discussed in Part One of the report. OIC countries need to use water resources in the most productive way by encouraging efficient use of water and relocating water from less to uses that are more beneficial. Also levels of non-revenue water – *which reflect volumes of water being lost through leaks, not being invoiced to customers, or both* – has to be reduced especially in countries where water losses are high such as Albania, Turkey and Kyrgyzstan, where annual water loss is above 50%. The last piece of the puzzle in managing water demand in OIC countries is reducing the demand for water. Of course, access to water is a basic human right that should be protected by laws and policies. However, access to water beyond the necessary minimum, such as for swimming pools, lawns, agriculture, or industrial purposes, should be appropriately priced. Further, if consumption that exceeds the minimum water requirement per person per day is charged at higher tariffs, then people will be forced to economise on water. In general, governments must recognize the extent of fresh water misuse, abuse, and crimes, and price water supply and sanitation services to reflect more appropriately their economic value, while making provisions for those in poverty. Islamic Religion can serve as an effective tool in influencing people's decisions around water in their daily lives. Religious organizations should advocate for protecting fresh water from a religious and ethical standpoint, thus facilitate cultural and social changes needed for more responsibly use of water by people.

A key aspect for sound water management and effective actions is data collection. Only if the volume of water consumption in every area is precisely known, water can be managed in a good way. Data collection will also be supportive to better monitoring of hydrological and hydro-climatic processes, trends in water quality, as well as monitoring of the loss of water in public networks, which is necessary to raise awareness and provide a basis for future water actions.

Data collection is also necessary for improving water efficiency in the agricultural sector, which accounts for as much as 84% of total water consumption in the OIC countries. In attempts to reduce the total water withdrawals by this sector, countries should have information such as what kind of crops are cultivated, what is the amount of water they consume, which corps have proved to be drought-resistant, as well as which are the corps that increase groundwater replenishment. In this context, the OIC Member States should reward farmers that are implementing agricultural conservation practices such as no-till farming, using filter strips, and planting crops that increase groundwater replenishment and help in achieving positive

environmental outcomes. This kind of practices are supportive to building resilience to the climate effects, which are placing an even greater stress on water supplies.

Water governance in all its forms has to allow all relevant public and private stakeholders to participate in decision-making, through studying good practices and adopting lessons learned. The objectives of different water stakeholders may be misaligned and contradictory; therefore, harmonizing the actions of different water stakeholders is paramount to achieve optimized and sustainable water use. Moreover, a cross-sectoral approach is necessary for better coordination of sectoral strategies and integrated planning (linking of water with agricultural, energy and other relevant policies) in order to reduce jurisdictional fragmentation that often acts as a barrier to improved water management practices. Here it is worthy to note that more often than not, the causes of water-related challenges or the solution to these challenges lie outside the water domain. A case in point comes from the energy sector. Renewable forms of energy such as power generation from solar photovoltaic and wind can help meet the increased demand for electricity without consuming water, particularly in the OIC countries where growing populations, farms and industries are already competing for scarce water supplies. Here it is interesting to note that some water-stressed OIC countries have high solar and wind potential.

When it comes to issues related to transboundary fresh waters, the OIC should recognize water as an essential factor in establishing peace and security in its geography. In this context, the OIC should encourage strengthening the transboundary water cooperation and act as a mediator in fresh water related conflicts.

There are various water cooperation mechanisms in the world and there does not seem to be one specific type of mechanism that guarantees active water cooperation over shared waters. Still, a combination of commitment at the highest political level, a collaborative management systems and clear rules acceptable to all riparian countries are important components of systemic water cooperation. Some fresh water cooperation systems in the OIC area, such as the Senegal River Basin Development Organization (OMVS), the Gambia River Basin Development Organization (OMVG) and the Niger Basin Authority (NBA) have proven to be very effective, and should be used as good examples.

The OIC Water Vision is an excellent framework for addressing the major water challenges facing OIC countries. Realizing the OIC Water Vision gained considerable momentum with the establishment of the OIC Water Council pursuant to the recommendation of the First Session of the Islamic Conference of Ministers responsible for Water held in March 2009 and resolution of the Second Session of the Islamic Conference of Ministers responsible for Water held in Istanbul in March 2012. The terms of reference for the OIC water Council were later adopted by the Third Islamic Conference of Water Ministers held in Istanbul, Turkey in May 2016.

The Water Council is to work under the authority and guidance of the Islamic Conference of Ministers responsible for Water to implement the Water Vision for a water-secure future of OIC Member States enshrined also in UN Sustainable Development Goals (SDGs). The OIC

Water Council has the specific purpose of: promoting activities recommended by the OIC Water Vision, capacity building and exchange of experience through collaboration among OIC stakeholders, elaborating on a potential financial mechanism and demonstrating success for future consideration of greater cooperation among OIC Member States.

The OIC Water Council is also expected to encourage technical cooperation among the Member States, research and educational institutions, private sector and other possible stakeholders for implementation of the OIC Water Vision by focusing on: (i) Connecting institutions within the OIC in water science, technical policy management and technology development to build capacity, and share and enhance knowledge; (ii) Supporting OIC Member States to overcome water related challenges through increased dialogue and exchange of experience as well as through promoting concrete actions; and (iii) Promoting scientific measures to water related challenges in the national and international agenda of OIC leaders.

The first Meeting of the OIC Water Council was held in Istanbul, Turkey on 16 November 2017. The OIC Water Council in its first meeting developed an Implementation Plan for the OIC Water Vision. The implementation plan has five pillars:

- Assessment of the needs and capacities of the Member States.
- Identification of lead water institutes in Member States.
- Collaborative activities on capacity building, innovative technological ideas and developing training programs among research and training institutes of the Member States.
- Capacity building activities giving special focus on the needs of least developed OIC Countries to address water related challenges.
- Resource mobilization mechanisms for the implementation of water projects, particularly in Least Developed OIC countries.

Successfully executing the implementation plan will require the full participation of the member countries and the support of the OIC General Secretariat and the relevant OIC institutions. In this regard, SESRIC, COMSTECH, IDB and ISESCO have a big role to play. The implementation plan is a good plan with defined mechanisms. However, the plan is not without flaws. The most serious weakness is related to resource mobilization. The plan does not identify how OIC countries can cooperate on resource mobilization. It is recommended that the OIC Water Council revisit the issue of resource mobilization and that means of cooperation among member countries be outlined.

Finally, Turkey has championed water causes in the OIC including the establishment of the OIC Water Council and the development of the implementation plan for the OIC water vision. So far, great momentum has been achieved. Now chairing the OIC Water Council moves to Egypt and Egypt is expected to maintain that momentum and lead the OIC Water Council in the execution of the implementation plan.

APPENDIX

A. OIC Water Council Survey 2018 Questionnaire

Welcome to the OIC Water Council Survey 2018.

This questionnaire is being conducted to support the broad objectives of the Implementation Plan for the OIC Water Vision which was approved by the OIC Water Council in its first meeting held in Istanbul in the period 15-16 November 2017. The questionnaire intends to collect information on: the achievements and challenges in the implementation of the OIC Water Vision; training needs and capacities of the Member States; requirements of Member States in terms of water infrastructure; and challenges, priorities and strategies of the Member States for the 5-10 years ahead.

The results will be reported in the *OIC Water Report 2018* which will be *presented to the 4th session of the Islamic Conference of Ministers Responsible for Water Affairs* and to the *2nd Meeting of the OIC Water Council.*

This survey is expected to take approximately 45 minutes. Please contact SESRIC (research@sesric.org) for any further inquiries.

Your participation in this survey is highly appreciated.

Brief Info about OIC: Organization of Islamic Cooperation (OIC) is the second largest intergovernmental organisation after the United Nations, with the membership of 57 states in four continents. The OIC is the collective voice of the Muslim world to ensure and safeguard their interest on economic, social, and political areas. For more information, please check its official website: www.oic-oci.org

Brief Info about SESRIC: The Statistical, Economic, Social Research and Training Centre for Islamic Countries (SESRIC) is a subsidiary organ of the OIC based in Ankara, Turkey. The Centre is broadly responsible for collecting statistics, studying current socio-economic developments and organizing training programmes for the Member States. For more information, please check its official website: www.sesric.org

General Information

OIC Water Council

1. Please enter your country

Country	

2. Please provide us with your information

Name Surname	
Name of Institution	
Position	
Phone	
Fax	
E-mail	

I. Overview of Achievements and Challenges in the Implementation of the OIC Water Vision

OIC Water Council

3. Please give a brief overview of the efforts undertaken for the implementation of the OIC Water Vision in your country.

4. Has your country adopted a comprehensive 'Water Security' policy at the national level since 2012?

☐Yes

☐No

If yes, please mention the areas/policy themes updated/evaluated:

5. In case of a pre-existing policy, has your country updated or evaluated the national water security policy since 2012?

☐Yes

☐No

6. Please rank the following water security challenges from the OIC Water Vision in the order of their importance to your country (with 1 being the highest priority and 7 being the lowest priority):

- Water resource availability
- Ensuring access to water and sanitation services
- Balancing water use and food production
- Access to finance
- Transboundary waters
- Changing socio-economic climates
- Changing physical climates

7. Has your country developed specific policies, strategies, and/or actions for the following water related challenges?

Please explain the policy/strategy/action briefly.

Water resource availability	
Ensuring access to water and sanitation services	
Balancing water use and food production	
Access to finance	
Transboundary waters	
Changing socioeconomic climates	
Changing physical climates	

8. Please list any major achievements and/or breakthroughs you have experienced while implementing the OIC Water Vision in your country.

9. What are the main difficulties and obstacles in your country in the implementation of the OIC Water Vision?

☐Difficulties concerning institutional capacities
☐Technological difficulties
☐Difficulties concerning expertise and knowledge
☐Infrastructural difficulties

☐Difficulties concerning funding and finance

Please explain your choices briefly.

II. Training Needs and Capacities of Member States

OIC Water Council

10. How can your country assist other OIC member states in achieving water security?

☐Your country can offer assistance in the form of funding initiatives

☐Your country can assist with transfer of technology

☐Your country can assist in capacity building

Other (please specify)

11. Has your country/institution cooperated with another OIC country in an exchange programme (twinning, training, staff exchange etc.) to share information and experience?

If yes, please highlight the nature of the cooperation, the objectives, the time period, and participating countries.

12. Please indicate if your country *can offer training* in the following areas:

Subjects / Areas	Yes	No
1. Water Resources Management	☐	☐
Groundwater management	☐	☐
Administrative, regulatory methods for groundwater	☐	☐
Watershed and river systems management	☐	☐
Water quality management	☐	☐
Water services management	☐	☐

Integrated water resources management	☐	☐
2. Water Storage Techniques	☐	☐
3. Irrigation Systems	☐	☐
4. Methods of Water Data and Information Collection (Water Statistics)	☐	☐
5. Desalination	☐	☐
6. Water Supply and Sanitation	☐	☐
7. Flood Risk Management	☐	☐
8. Water Pollution	☐	☐
9. Wastewater Recycling	☐	☐
10. Water Governance (Regulations)	☐	☐
11. Others (please specify below)	☐	☐

13. Please indicate if your country *needs training* in the following areas.

Subjects / Areas	**Yes**	**No**
1. Water Resources Management	☐	☐
Groundwater management	☐	☐
Administrative, regulatory methods for groundwater	☐	☐
Watershed and river systems management	☐	☐
Water quality management	☐	☐
Water services management	☐	☐
Integrated water resources management	☐	☐
2. Water Storage Techniques	☐	☐
3. Irrigation Systems	☐	☐

4. Methods of Water Data and Information Collection (Water Statistics)	☐	☐
5. Desalination	☐	☐
6. Water Supply and Sanitation	☐	☐
7. Flood Risk Management	☐	☐
8. Water Pollution	☐	☐
9. Wastewater Recycling	☐	☐
10. Water Governance (Regulations)	☐	☐
11. Others (please specify below)	☐	☐

14. Please rank the priority level of your country's training needs that you selected in the previous question:

Survey 2018

Subjects / Areas	Low Priority	Medium Priority	High Priority
1. Water Resources Management	☐	☐	☐
Groundwater management	☐	☐	☐
Administrative, regulatory methods for groundwater	☐	☐	☐
Watershed and river systems management	☐	☐	☐
Water quality management	☐	☐	☐
Water services management	☐	☐	☐
Integrated water resources management	☐	☐	☐
2. Water Storage Techniques	☐	☐	☐
3. Irrigation Systems	☐	☐	☐
4. Methods of Water Data and Information Collection (Water Statistics)	☐	☐	☐
5. Desalination	☐	☐	☐
6. Water Supply and Sanitation	☐	☐	☐
7. Flood Risk Management	☐	☐	☐

8. Water Pollution	☐	☐	☐
9. Wastewater Recycling	☐	☐	☐
10. Water Governance (Regulations)	☐	☐	☐
11. Others (please specify below)	☐	☐	☐

III. Requirements of Member States in terms of Water Infrastructure

OIC Water Council

15. Does your country lack financial means necessary to build or upgrade necessary water infrastructure?

☐Yes

☐No

If no, skip to question 18.

OIC Water Council

16. Please list five main water infrastructure projects in your country that *needs upgrading*, in the order of their priority:

2018

Please enter project name, brief description, and estimated cost in US dollars	
Please enter project name, brief description, and estimated cost in US dollars	
Please enter project name, brief description, and estimated cost in US dollars	
Please enter project name, brief description, and estimated cost in US dollars	
Please enter project name, brief description, and estimated cost in US dollars	

17. Please list five main water infrastructure projects in your country that are *necessary to build*, in the order of their priority:

Please enter project name, brief description, and estimated cost in US dollars	
Please enter project name, brief description, and estimated cost in US dollars	
Please enter project name, brief description, and estimated cost in US dollars	
Please enter project name, brief description, and estimated cost in US dollars	

Please enter project name, brief description, and estimated cost in US dollars	

IV. The Way Forward: Main Challenges, Priorities, and Strategies for the next 5-10 years

OIC Water Council

18. Please list three main challenges that can affect your country's water security in the future?

Challenge 1:	
Challenge 2:	
Challenge 3:	

19. Please list three main priorities for your country that can ensure a water-secure future?

Priority 1:	
Priority 2:	
Priority 3:	

20. Does your country have any *strategies* for achieving water security to carry out at the national level over the next 5-10 years?

☐Yes

☐No

If yes, please explain briefly

End.

B. Country Classifications

OIC Countries (57):

Afghanistan	Gabon	Maldives	Sudan
Albania	Gambia	Mali	Suriname
Algeria	Guinea	Mauritania	Syria*
Azerbaijan	Guinea-Bissau	Morocco	Tajikistan
Bahrain	Guyana	Mozambique	Togo
Bangladesh	Indonesia	Niger	Tunisia
Benin	Iran	Nigeria	Turkey
Brunei Darussalam	Iraq	Oman	Turkmenistan
Burkina Faso	Jordan	Pakistan	Uganda
Cameroon	Kazakhstan	Palestine	United Arab Emirates
Chad	Kuwait	Qatar	Uzbekistan
Comoros	Kyrgyz Republic	Saudi Arabia	Yemen
Cote d'Ivoire	Lebanon	Senegal	
Djibouti	Libya	Sierra Leone	
Egypt	Malaysia	Somalia	

* Syria is currently suspended from OIC membership.

Non-OIC Developing Countries:

Angola	Dominica	Madagascar	São Tomé and Príncipe
Antigua and Barbuda	Dominican Republic	Malawi	Serbia
Argentina	Ecuador	Marshall Islands	Seychelles
Armenia	El Salvador	Mauritius	Solomon Islands
The Bahamas	Equatorial Guinea	Mexico	South Africa
Barbados	Eritrea	Micronesia	South Sudan
Belarus	Ethiopia	Moldova	Sri Lanka
Belize	Fiji	Mongolia	St. Kitts and Nevis
Bhutan	Georgia	Montenegro	St. Lucia
Bolivia	Ghana	Myanmar	St. Vincent and the Grenadines
Bosnia and Herzegovina	Grenada	Namibia	Swaziland
Botswana	Guatemala	Nauru	Tanzania
Brazil	Haiti	Nepal	Thailand
Bulgaria	Honduras	Nicaragua	Timor-Leste
Burundi	Hungary	Palau	Tonga

Cabo Verde	India	Papua New Guinea	Trinidad and Tobago
Cambodia	Jamaica	Paraguay	Tuvalu
Central African Republic	Kenya	Peru	Ukraine
Chile	Kiribati	Philippines	Uruguay
China	Kosovo	Poland	Vanuatu
Colombia	Lao P.D.R.	Romania	Venezuela
Democratic Republic of the Congo	Lesotho	Russia	Vietnam
Republic of Congo	Liberia	Rwanda	Zambia
Costa Rica	FYR Macedonia	Samoa	Zimbabwe
Croatia	Panama		

Developed Countries (39):**

Australia	Germany	Lithuania	Singapore
Austria	Greece	Luxembourg	Slovak Republic
Belgium	Hong Kong	Macao SAR	Slovenia
Canada	Iceland	Malta	Spain
Cyprus	Ireland	Netherlands	Sweden
Czech Republic	Israel	New Zealand	Switzerland
Denmark	Italy	Norway	Taiwan
Estonia	Japan	Portugal	United Kingdom
Finland	Korea, Rep.	Puerto Rico	United States
France	Latvia	San Marino	

** Based on the list of advanced countries classified by the IMF.

C. Geographical Classification of OIC Countries

Sub-Saharan Africa (21): OIC-SSA

Benin	Gambia	Nigeria
Burkina Faso	Guinea	Senegal
Cameroon	Guinea-Bissau	Sierra Leone
Chad	Mali	Somalia
Comoros	Mauritania	Sudan
Côte d'Ivoire	Mozambique	Togo
Gabon	Niger	Uganda

Middle East and North Africa (19): OIC-MENA

Algeria	Kuwait	Saudi Arabia
Bahrain	Lebanon	Syria*
Djibouti	Libya	Tunisia
Egypt	Morocco	United Arab Emirates
Iraq	Oman	Yemen
Iran	Palestine	
Jordan	Qatar	

Europe and Central Asia (8): OIC-ECA

Albania	Kyrgyzstan	Turkmenistan
Azerbaijan	Tajikistan	Uzbekistan
Kazakhstan	Turkey	

South Asia (4): OIC-SA

Afghanistan	Maldives	Pakistan
Bangladesh		

East Asia Asia (3): OIC-EA

Brunei Darussalam	Indonesia	Malaysia

Latin America (2): OIC-LA

Guyana	Suriname

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